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Profile of Existing Hazardous Waste Incineration Facilities and Manufacturers in the United States

MITRE Corp., McLean, VA

Prepared for

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A PROFILE OF EXISTING HAZARDOUS WASTE INCINERATION FACILITIES AND MANUFACTURERS IN THE UNITED STATES

by

Edwin Keitz
Greg Vogel
Rich Holberger
Leo Boberschmidt
Mitre Corporation
Metrek Division
McLean, Virginia 22102

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Project Officer

C.C. Lee
Energy Pollution Control Division
Industrial Environmental Research Laboratory
Cincinnati, Ohio 45268

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A wide variety of technical data pertaining to hazardous waste incinerators has been obtained both from incinerator manufacturers and facilities operating hazardous waste incinerators. This document discusses the data gathering and verification procedures and presents tabulations of the data. It is estimated that there are approximately 350 operational hazardous waste incinerators at 270 facilities in the United States which are subject to regulation under the Resource Conservation and Recovery Act.

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A wide variety of technical data pertaining to hazardous waste incinerators has been obtained both from incinerator manufacturers and facilities operating hazardous waste incinerators. This document discusses the data gathering and verification procedures and presents tabulations of the data. It is estimated that there are approximately 350 operational hazardous waste incinerators at 270 facilities in the United States which are subject to regulation under the Resource Conservation and Recovery Act.

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1.0 INTRODUCTION AND SUMMARY

1.1 Background

The control of hazardous waste (HW) continues to be of major concern to the U.S. Environmental Protection Agency (EPA). In response to Congressional legislation (Resource Conservation and Recovery Act (RCRA) of 1976, P.L. 94-580, as amended) EPA is developing a comprehensive control program to ensure proper handling of waste from its generation to ultimate disposal.

A major component of this program addresses the incineration of hazardous wastes. Incineration is considered "a proven method of destroying organic waste without posing a threat to the environment" (U.S. EPA, 1980a). Considering the amount of such waste which requires disposal, the amount of hazardous wastes incinerated may increase by an order of magnitude or more.

Regulations governing hazardous waste incineration were proposed on December 18, 1978 specify performance and operating standards. After public comment, these regulations were modified on January 23, 1981, to include only performance standards. The performance standards govern the emissions of hazardous waste constituents, hydrogen chloride, and particulate matter from incinerators.

While developing the regulations, the EPA identified a need for a technical data base correlating specific incinerator operating and design features with the ability to satisfactorily destroy hazardous wastes. The Incineration Research Branch (IRB) of EPA's Industrial Environmental Research Laboratory in Cincinnati has a large multifaceted program underway to develop such a data base. The objectives of this data base were enumerated as follows (U.S. EPA, 1980b):

> "(1) to support the current RCRA 3004 incineration regulations;
>
> (2) to provide direct technical support to regional permit and compliance programs;
>
> (3) to expand and refine the state of best engineering judgement regarding hazardous waste incineration; and,
>
> (4) to form the sound technical basis for development and promulgation of detailed design, performance and operating standards for hazardous waste incinerators in future revised regulations."

The MITRE Corporation is under contract to IRB to assist in the development of this hazardous waste incineration data base. Previous tasks on this contract included a user needs study (Barrett et al., 1981) and an analysis of existing data management systems (Keitz and Dratch, 1982). As a result of these studies, a recommendation was made to IRB to concentrate development efforts on modification and expansion of EPA's existing Hazardous Waste Data Management System (HWDMS). This expanded portion of the data base is called the Hazardous Waste Control Technology Data Base (HWCTDB).

1.2 Current Effort

A major part of this effort centered on the collection of various types of hazardous waste incineration data in support of the IRB objectives. Two of the types of data collected were:

- Design features, operating characteristics, and number in service estimates for hazardous waste incinerators based on contact with manufacturers of incinerators.
- Design information, operating conditions, and detailed waste characterization for operational hazardous waste incinerators based on information provided by HW facility spokesmen.

This report presents the results of both of the data collection efforts. Section 2.0 discusses data collection from manufacturers of incinerators and related equipment. The collected data were used to generate a profile of the domestic hazardous waste incinerator manufacturing industry. Section 3.0 discusses data collection from facilities known or thought to be possible operators of one or more hazardous waste incinerators, presents tabulations of the data collected, and discusses the findings. Both the manufacturers data and the operational data were collected in part for entry into the HWCTDB.

1.3 Summary of Principal Findings

Incinerator manufacturers' information was obtained from interviews and sales literature provided by the 57 domestic companies identified as HW incinerator manufacturers. Information on existing facilities was obtained from 514 of 566 facilities listed in HWDMS as HW incinerators on 30 November 1981 plus 23 facilities identified outside the HWDMS data base. The summary findings presented below are based on the information provided by these 57 manufacturers and 537 facilities.

Table 1 presents a comparison of the number of HW incinerators as reported by both manufacturers and representatives of existing HW facilities. A total of 284 operational HW incinerators were verified at 219 facilities. A review of the HWDMS and other sources at the end of this study produced a list of 128 potential incineration facilities which had not been contacted. These included new additions to HWDMS, and facilities which could not be contacted during the study. If a projection of the facility population figures is made to account for these 128 potential facilities, the total operational HW incinerator population would be approximately 350 units at 270 facilities. This figure agrees very well with the 335 operational units reported by manufacturers. In contrast, existing facilities reported 32 units under construction which is much higher than the 7 reported by manufacturers.

Table 2 presents a comparison of the types of operational HW incinerators reported by manufacturers and HW facilities. The manufacturer's data and the projected total existing populations agree extremely well for the liquid injection and hearth type incinerators. However, the rotary kiln population reported by manufacturers is more than double the number reported by facilities.

Of the 264 operational incinerators whose type was specified, 208 (79 percent) are capable of burning liquids by injection. Twenty-nine units (11 percent) are capable of burning bulk wastes (solids or liquids). The remaining units are mostly special purpose

TABLE 1

COMPARISON OF NUMBER OF HW INCINERATORS REPORTED BY MANUFACTURERS AND HWI FACILITIES

	Reported by HWI Facilities Contacted		
	Actual Number Reported	Projection for Total Population	Reported by Manufacturers
Operational Incinerators*	284	350	335
Units under Construction	32	40	7
Total Reported	316	390	342

---

*Operational incinerators are defined as those currently burning hazardous waste or which are temporarily shut down for maintenance or other causes.

TABLE 2

COMPARISON OF THE TYPES OF OPERATIONAL HW INCINERATORS REPORTED BY MANUFACTURERS AND HWI FACILITIES

	Reported by HWI Facilities Contacted		
	Actual Number Reported	Projection for Total Population	Reported by Manufacturers
Liquid Injection	160[(a)]	213	219
Hearths	56[(b)]	75	70
Rotary Kiln	13[(b,c)]	17	37
Fluidized Bed	4	5	9
Others	31[(d)]	42	(e)
Type Not Specified	20	0	(e)
Total Operational	284	352	335

(a) = includes fume/liquid units.
(b) = includes units both with and without liquid injection.
(c) = includes 2 rotary kilns in combination units.
(d) = includes 3 combination units not having a rotary kiln.
(e) = this category not obtained from manufacturers.

types such as steel drum reconditioning burners or military ammunition disposal equipment.

Additional findings based on analyses of the existing facilities data include*:

- Design capacities were reported for 180 incinerators burning liquids and 44 incinerators burning solids. The median design capacity of incinerators burning liquids is 150 gallons per hour with most units (86 percent) not exceeding 1000 gallons per hour. Incinerators burning solids tend to have smaller capacities with the median being approximately 650 pounds per hour (equivalent to 78 gallons of water).
- Of the 219 facilities reporting, 71 (32 percent) reported operating continuously 24 hours per day, 7 days per week. The majority of all incinerators (62 percent) reported intermittent operations either on a fixed schedule or an "as needed" basis. The remaining 13 units (6 percent) were on standby or long term shut down but still considered operational by the facility.
- Combustion temperatures were reported for 173 incinerators. Gaseous residence times were reported for 104 incinerators. The median combustion temperature for HW incineration is approximately 1800°F, and median gaseous residence time is slightly under 2 seconds. Units operating at higher temperatures also tend to have longer residence times.
- Most of the wastes reported are liquids, principally spent non-halogenated solvents and aqueous solutions of corrosives, reactives or ignitables. The most frequently reported waste was the non-listed ignitable waste with high heat content (over 6000 Btu per pound). This waste was reported for 69 incinerators. The largest single category of waste by weight was non-halogenated solvents, accounting for 233,000 tons per year at 18 incinerators. This is approximately 23 percent by weight of all wastes reported. However, approximately 600,000 tons per year (59 percent) of all wastes reported were aqueous hazardous wastes.

---

*Since some respondents did not provide data on one or more topics, the sample size varies from one topic to another.

- Air pollution control devices (APCD's) were reported on 45 percent of the incinerators. Some form of scrubber system was used on 83 percent of the units with APCD's. Larger incinerators are more likely to have control devices than smaller units.

- Incinerators with high combustion temperatures and long gaseous residence times are more likely to have air pollution control devices than other units.

- Heat recovery units were reported on 22 percent of the incinerators. The use of heat recovery tends to be related to the continuity of incinerator operation.

- Although the data were not subjected to formal statistical analysis, there appears to be a correlation between the location of HW incinerator facilities and chemical industry centers. For example, of the 219 facilities identified, 52 (24 percent) are located in Texas or Louisiana.

- Privately owned and operated ("on-site") facilities (including university facilities) account for 80 percent of the total. The remaining facilities are mostly commercial facilities or military ammunition disposal operations.

- Most of the incinerators (104 out of 128 reporting) do not exceed 10 years in age. Sixty units (47 percent) are in the 6 to 10 year age range.

- Due to the structure of the data gathering and verification procedures, it was not possible to estimate the extent to which hazardous waste may be incinerated in devices exempt from the RCRA HW incinerator regulations, such as boilers or process kilns.

The above capsule profile of HW incineration in the United States tends to substantiate many concepts which heretofore were mostly assumptions. These include the location, type, and capacities of HW incinerators. On the other hand, some previously existing assumptions will require modificaton. Among these are the number of facilities, the nature of wastes incinerated, and the hours of operation.

Many respondents voiced the opinion that the decision to operate a HW incinerator was selected only when other choices such as material recovery, recycling, energy recovery or other disposal methods were not cost effective.

2.0 PROFILE OF THE HAZARDOUS WASTE INCINERATOR MANUFACTURING INDUSTRY

This section contains a summary of the numbers, types, and characteristics of hazardous waste incineration systems in use in the United States, based on information obtained from incinerator manufacturers.

2.1 Identification of Manufacturers

During February and March 1981, incinerator manufacturers were contacted in order to determine those marketing hazardous waste units. Four directories were used to provide names, addresses and some telephone numbers of manufacturers, specifically the:

- 1981 Chemical Engineering Catalog
- February 1981 Buyer's Guide, Solid Waste Management Magazine
- 1981 Catalog and Buyer's Guide, Pollution Equipment News
- 1980-81 Directory and Resource Book, Air Pollution Control Association.

Additional manufacturers were identified by the manufacturers listed in the directories and by Mr. Lawrence G. Doucet, a consultant to EPA. The hazardous waste incinerator manufacturers identified during this survey are listed in Appendix A.

2.2 Summary of Information Provided by Manufacturers

Hazardous waste incinerator manufacturers were asked to provide information about the types of incinerators manufactured, the approximate number of units sold between 1969 and 1981, and design and operating information. 1969 was selected as a cutoff date based upon several manufacturers' estimates that 12 years of useful service may be expected from a hazardous waste incinerator. A summary of the number of manufacturing companies and the number of incinerators in service classified by type is presented in Table 3. There are four major types of hazardous waste incinerators: hearth, liquid injection, rotary kiln, and fluidized bed. Hearth incinerators include fixed hearth, multiple chamber hearth, pulse hearth, rotary hearth, and reciprocating grate units. Liquid injection incinerators are most prevalent with 64.0 percent of the market, hearth incinerators comprise 20.8 percent of the units sold, and 12.3 percent of the incinerators are rotary kilns. These three types account for 97 percent of the units manufactured. A classification of incinerator manufacturers by the type of units they sell is presented in Table 4 and the number of incinerators sold by each company and other pertinent data are presented in Table 5.

Of the 57 companies identified as marketing hazardous waste incinerators, 28 have sold no units in the United States. Apparently many of the companies that have not sold an incinerator are anticipating a large market growth. Of the 23 companies marketing liquid injection incinerators, eight have sold none to date; eight of the 17 companies offering rotary kiln incinerators have sold none to date; and five of the nine companies offering fluidized bed incinerators have sold none to date. All hearth incinerator manufacturers have sold at least one unit. Most of the

TABLE 3

NUMBER OF HAZARDOUS WASTE INCINERATORS IN THE UNITED STATES BY DOMESTIC MANUFACTURERS

Type of Incinerator	Number of Manufacturing Companies	Incinerators in Hazardous Waste Service	Percent of Total
Liquid Injection	23	219	64.0
Hearth			
Fixed	12	59	17.3
Multiple Chamber	2	7	2.0
Pulse	1	2	0.6
Rotary	1	2[c]	0.6
Rotary Kiln	17	42[a,b]	12.3
Fluidized Bed	9	9	2.6
Salt Bath	2	0	---
Induction Heating	1	0	---
Reciprocating Grate	1	1	0.3
Infrared Heating	1	1[c]	0.3
Open Drum	1	0	---
Total		342	100.0

[a] Includes five units in construction.
[b] Includes one oscillating kiln.
[c] One unit is in construction.

TABLE 4

MANUFACTURERS OF INCINERATOR TYPES

Hearth Incinerators

Basic Environmental Engineering
Bayco
Burn-Zol
Comtro Div. of Sunbeam
Consumat
Econo-Therm Energy Systems
Enercon Systems
Environmental Control Products
Entech Industrial Systems
Kelly Co.
Midland-Ross
Morse Boulger
P & T Manufacturing
Plibrico Co.
U.S. Smelting Furnace
Washburn and Granger

Liquid Injection Incinerators

Air Resources
Baumco
Bigelow Liptak
Brule'
C&H Combustion
CEA Combustion
CE Raymond
Coen
Entech Industrial Systems
Hirt Combustion
Howe-Baker Engineers
McGill
Met-Pro
Peabody International
Prenco
Shirco
Sur-Lite
Tailor
Trane Thermal
The United Corporation
John Zink

Rotary Kiln Incinerators

Bigelow Liptak
CE Raymond
CEA Combustion
C&H Combustion
Fuller Co.
Howe-Baker Engineers
Industronics
International Incinerators
Met-Pro
TR Systems
Thermall
Trofe
United Corporation
Vulcan Iron Works

Fluidized Bed Incinerators

CE Raymond
Copeland Associates
Dorr Oliver
Energy Inc.
Fuller Co.
Nichols Engineering
Tailor and Co.
Thermal Processes

TABLE 4 (Concluded)

Other Types of Incinerators

CICO-Semi-Suspension
Commercial Fabrication and Machine Co.-Package Incinerator
Ecologenics-Molten Salt
Midland-Ross-Rotary Hearth
Nichols Engineering-Rotary Hearth
Pyro-Magnetics-Induction Heating
Rockwell-Molten Salt
Shirco-Infrared

Vendors of European Technology

Dravo-Steinmuller-Liquid Injection and Rotary Kiln
Environmental Elements-Von Roll Rotary Kiln
HPD-Bertrams Oil Cooled Combustion Chamber
Lurgi-Liquid Injection, Hearth, Rotary, Kiln, and Fluidized Bed
Niro-Fluidized Bed
Perstorp-Drum Incinerator

TABLE 5

HAZARDOUS WASTE INCINERATOR VENDOR DATA FOR THE UNITED STATES

Number	Company	Type Incinerator* Built	Units Sold in U.S.	Unit* Capacity	Nature of Wastes	Comments
1	Air Resources	L.I., followed by catalytic converter	1	5 gph	Liquid	Firm is primarily in fume incin. business. Supplies H.W. incins. only on request
2	Basic Environmental Engineering, Inc.	Pulse Hearth	2	6×10^6 Btu/hr 20×10^6 Btu/hr	Paint Residues Residual cutting oils, other	Does not solicit H.W. business
3	Baumco, Inc.	L.I.	0	-	-	Primarily a burner vendor
4	Bayco Industries of California	Fixed hearth, Multi-chamber afterburner	≤12	Mostly 200-300 pph. Up to 600 pph.	Solids, sludges, liquids	
5	Bigelow-Liptak Corp.	L.I. R.K.	19 1	Mostly 7-10 $\times 10^6$ Btu/hr or 30-40 $\times 10^6$ Btu/hr	Mostly chlorinated hydrocarbons	
6	Brule' C.E. & E., Inc.	L.I.	5	3.5-8.5 $\times 10^6$ Btu/hr	Chlorinated hydrocarbons	Vendor also mfgs. fume incinerators
7	Burn-Zol Corp.	Fixed Hearth	18	3-100 gph on liquids. 200-1800 pph on solids or solids & liquids	Plating wastes, Paint solvents and sludges, Plastic residues	Vendor also mfgs. fume incinerators
8	C&H Combustion	R.K.	2	10×10^6 Btu (1000-2000 lb)/hr 120×10^6 Btu/hr	Pharmaceutic wastes Commercial industrial wastes	
		L.I.	1	Unk.	Organics, silicones	
9	CEA Combustion, Inc.	L.I. & R.K.	~17 L.I. ~ 3 R.K.	10×10^6 or 30-40 $\times 10^6$ Btu/hr	Liquids, Solids	Also mfgs. fume incinerators. Sees sales trend to R.K.

Abbreviations used:
L.I. - Liquid Injection
H.W. - Hazardous Waste
gph - gallons per hour
R.K. - Rotary Kiln
pph - pounds per hour
Unk. - unknown
F.B. - Fluidized Bed
tpd - tons per day
F.H. - Fixed Hearth
gpd - gallons per day

TABLE 5 (Continued)

Number	Company	Type Incinerator* Built	Units Sold in U.S.	Unit* Capacity	Nature of Wastes	Comments
10	CE Raymond, Bartlett-Snow Division	R.K., L.I., F.B.	16 R.K. (+3 in construction) 0 L.I. 0 F.B.	6@5-7 x 10^6 Btu/hr 1@ 10 x 10^6 Btu/hr 1@ 25 x 10^6 Btu/hr 8@ 50 x 10^6 Btu/hr	Solids, Semi-solids, Liquids	Appears to be the major supplier of R.K.
11	CICO, Inc.	"Semi-suspension" process	0	---	---	Test unit in development
12	Coen Co.	L.I.	2 known; others possibly	75 x 10^6 and 67 x 10^6 Btu/hr 20,000 gpd unit in construction	Mixed H.W. and Industrial Wastes	
13	Commercial Fabrication and Machine Co., Inc.	"Novel type package incinerator"	0	200 pph	Unk.	Unit in development. Allegedly usable for H.W.
14	Copeland Associates, Inc.	F.B.	2	8-9 x 10^6 Btu/hr	Refinery Wastes	
15	Dorr Oliver, Inc.	F.B.	5	1 @ 35 x 10^6 Btu/hr 1 @ 50 x 10^6 Btu/hr 2 @ 67 x 10^6 Btu/hr 1 @ 370 tpd	Pulp Mill Black Liquor Neutral Sulfite Liquor Wet Sludges Contg. Oily Matter	
16	Dravo Engineers and Constructors	R.K., L.I.	0	---	Multiple types of waste	Designs and installs complete H.W. facilities based on Bayer/Steinmuller technology
17	Ecologenics Corp.	Salt Bath	0	---	---	Unit in Development
18	Econo-Therm Energy Systems Corp.	Fixed hearth, w/starved air	≤10	50 to 2500 pph	Unk.	Also builds cofiring municipal incins. R&D on FB unit
19	Enercon Systems, Inc.	Fixed Hearth	2; possibly others	600 pph 240 tpd	Insecticides Munic. wastes plus liquid H.W.	Also developing a rotary hearth design

Abbreviations used:				
	L.I. - Liquid Injection	R.K. - Rotary Kiln	F.B. - Fluidized Bed	F.H. - Fixed Hearth
	H.W. - Hazardous Waste	pph - pounds per hour	tpd - tons per day	gpd - gallons per day
	gph - gallons per hour	Unk. - unknown		

TABLE 5 (Continued)

Number	Company	Type Incinerators* Built	Units Sold in U.S.	Unit* Capacity	Nature of Wastes	Comments
20	Energy, Inc.	F.B.	0	-	-	Pilot plant is test burning HW
21	Entech Industrial Systems, Inc.	L.I. and Multiple Hearth	6 L.I. 6 M.H.	50-500 gpd 1000-1500 ppd	liquids solids	Also mfgrs. fume incinerators
22	Environmental Control Products, Inc.	Fixed, stepped hearth	Unk.	300-1000 pph	Unk.	Also builds incin. for radioactive wastes and for municipal wastes
23	Environmental Elements Corp.	R.K.	0	---	Liquids, solids and fumes	Marketing European technology that is widely used in Europe and Japan
24	Fuller Co.	F.B. & R.K.	Unk.	---	---	Has F.B. and R.K. units in operation but nature of wastes is unknown
25	HPD, Inc.	L.I.	0	---	Unit specific for salt-containing organic/aqueous wastes	Unique European technology
26	Hirt Combustion Engineers	L.I.	5-10 (assume 8)	1-10 gpm	Haz. Liquids	All units custom built. Also engineers fume incinerators.
27	Howe-Baker Engineers, Inc.	L.I., R.K.	0	---	---	Company is quoting on several L.I. facilities. Company also manufactures burners.
28	Industronics, Inc.	R.K.	0	---	Liquids and solids	Designs emphasize energy and precious metals recovery. Actively marketing.
29	International Incinerators, Inc.	R.K.	3 +2 in construction	5-100 x 10^6 Btu/hr	Chlorinated hydrocarbons Tars	
30	John Zink Co., The	L.I. (primarily) Oxidative or Starved Air	75 (±10) (since Jan. 1969)	5-300 x 10^6 Btu/hr Avg. is 30-50 x 10^6 Btu/hr	All types liquids	75% of units sold in last 3 yrs. include heat recovery. Recently, this is 95%. Also mfg. fume incinerators

Abbreviations used:
L.I. - Liquid Injection
H.W. - Hazardous Waste
gph - gallons per hour
R.K. - Rotary Kiln
pph - pounds per hour
Unk. - unknown
F.B. - Fluidized Bed
tpd - tons per day
F.H. - Fixed Hearth
gpd - gallons per day

TABLE 5 (Continued)

Number	Company	Type Incinerator* Built	Units Sold in U.S.	Unit* Capacity	Nature of Wastes	Comments
31	Kelley Co., Inc.	Fixed hearth, starved air, for solids and/or liquids	3 in construction	1 @ 9×10^6 Btu/hr 2 @ 3×10^6 Btu/hr	Waste oils, solvents, aqueous solns contg. organics, solids	
32	Lurgi Corp. (formerly BSP Envirotech)	Fixed Hearth, Multiple Hearth, R.K., F.B.	5 (3 Fixed Hearth 1 Multi-hearth 1 R.K.)	-	---	Designs and installs (turnkey) complete facilities
33	McGill, Inc.	L.I.	0	---	---	Now quoting on several units for H.W. service
34	Met-Pro Corporation Systems Div.	R.K., L.I.	2 R.K. 1 L.I.	50 gph/each 120 gph	Unk.	
35	Midland-Ross Corp.	Rotary Hearth Pyrolyzer	1 (2nd unit near start-up)	3,600 pph 5,800 pph	Organic solids, sludges	Unit touted for use on sludges with large metal content
36	Morse Boulger	Fixed Hearth	3	650-1000 pph	Unk.	Relatively new in this business
37	Niro Atomizer Inc.	F.B.	0	---	---	Actively marketing
38	P&T Manufacturing Co.	Fixed Hearth (starved air), R.K.	5 FH 0 RK	25-1000 pph	Paint solvents Chemical slurries	
39	Peabody International Corp.	L.I. single or dual chamber	2 (possibly others)	99×10^6 Btu/hr 41×10^6 Btu/hr	Oil and acid sludges, solvents, paints, tars, oils, etc.	Also mfgs fume incinerators, burners, and other related equipment
40	Perstorp, Inc.	Oxidative incin. of H.W. contained in open-end drums	0	---	Liquids and solids	One H.W. facility operating in Sweden
41	Plibrico Co.	F.H.	Unk.	Unk.	Unk.	Custom-engineered units; not actively marketing
42	Prenco, Inc.	L.I.	~22	3-112 x 10^6 Btu/hr	Varied	

Abbreviations used:
L.I. - Liquid Injection
H.W. - Hazardous Waste
gph - gallons per hour
R.K. - Rotary Kiln
pph - pounds per hour
Unk. - unknown
F.B. - Fluidized Bed
tpd - tons per day
F.H. - Fixed Hearth
gpd - gallons per day

TABLE 5 (Continued)

Number	Company	Type Incinerator* Built	Units Sold in U.S.	Unit* Capacity	Nature of Wastes	Comments
43	Pyro Magnetics Corp.	Pyrolysis using Induction heating	0	---	---	Constructing a mobile test unit. New company.
44	Rockwell International	Molten Salt Bath	0	---	---	Actively marketing; making quotations in several units
45	Shirco, Inc.	L.I., and Infra-Red, belt-driven chamber w/ or w/o gas-fired afterburner	1 Infra-Red unit in construction 0 LI	50 pph	Phenolic sludges	Infra-Red pilot unit available for testing
46	Sunbeam Equipment Corp., Comtro Div.	Controlled Air 2-stage, F.H.	2 (possibly others)	200 & 800 pph	Solids, plastics wastes	Not highly interested in H.W. market
47	Sur-Lite Corp.	L.I.	3	60, 200 and 500 gph	Oily wastes shale oil residues	
48	TR Systems	R.K.	8	4 @ 1-3 x 10^6 Btu/hr 1 @ 7 " " 1 @ 10 " " 1 @ 20 " " 1 @ 28 " "	Unk.	Has proprietary scrubber design
49	Tailor and Co., Inc.	L.I. and F.B.	2 F.B. 0 LI	2 and 10 x 10^6 Btu/hr	Unk.	75 x 10^6 Btu/hr. F.B. unit in design
50	Thermal Processes, Inc.	F.B.	0	---	---	
51	ThermAll, Inc.	R.K.	0	---	---	One unit in construction
52	Trane Thermal Co.	L.I.	54	5 to 130 x 10^6 Btu/hr	Chlorinated hydrocarbons, tarry still bottoms, formaldehyde, etc.	Also mfg. fume incinerators
53	Trofe, Inc.	Starved Air, Oscillating, R.K.	0	---		25 x 10^6 Btu/hr test unit for liquids, solids and mixtures
54	The United Corporation	L.I.	3	1 @ 10 x 10^6 Btu/hr 2 @ 15 x 10^6 Btu/hr	Unk.	6 x 10^6 Btu/hr test unit available

Abbreviations used:

L.I. - Liquid Injection	R.K. - Rotary Kiln	F.B. - Fluidized Bed	F.H. - Fixed Hearth
H.W. - Hazardous Waste	pph - pounds per hour	tpd - tons per day	gpd - gallons per day
gph - gallons per hour	Unk. - unknown		

TABLE 5 (Concluded)

Number	Company	Type Incinerator * Built	Units Sold in U.S.	Unit * Capacity	Nature of Wastes	Comments
55	U.S. Smelting Furnace Company	Fixed Hearth	1	4.6 x 10^6 Btu/hr	Solvents	Does not seek H.W. incin. business
56	Vulcan Iron Works, Inc.	R.K.	1	25 tpd	Solids and liquids	
57	Washburn and Granger Co., The, Inc.	Reciprocating grate; controlled air	1	Unk.	liquids and fumes	

Abbreviations used:
L.I. - Liquid Injection
R.K. - Rotary Kiln
F.B. - Fluidized Bed
F.H. - Fixed Hearth
H.W. - Hazardous Waste
pph - pounds per hour
tpd - tons per day
gpd - gallons per day
gph - gallons per hour
Unk. - unknown

companies offering innovative incineration technology have not sold any units to date.

Trane Thermal and John Zink have established strong market positions in liquid injection incinerators, accounting for sales of 59 percent of those units. C. E. Raymond has sold 38 percent of the rotary kilns in service. Sales of hearth incinerators are distributed evenly among the manufacturers. Four domestic manufacturers produce more than one type of incinerator.

The total number of operational HW incinerators (342) from this survey agrees well with the 352 incinerators estimated to be operational based on contact with RCRA Part A permit applicants listed in the EPA Hazardous Waste Data Management System (HWDMS). Reasons for the small discrepancy include: some of the units sold since 1969 may no longer be in use or may be used to burn non-hazardous wastes; and some manufacturers might not have enough information to know whether the customer's wastes are hazardous.

2.3 Incinerator Design Information

Incinerator design information was obtained from interviews with fourteen incinerator manufacturers and sales literature provided by all 57 companies in order to survey general design practices. The interviews included six with rotary kiln manufacturers, one with a fluidized bed incinerator manufacturer, and five with liquid injection incinerator manufacturers. The sales literature obtained from hearth incinerator manufacturers offers considerably more design information than the literature of other manufacturers, primarily because hearth incinerators are generally sold as standard, preassembled units. The following design features of the four major types of incinerator are discussed in this chapter:

- Combustion chamber design
- Incinerator capacities
- Energy recovery equipment
- Air pollution control equipment

Designs of European origin are not included in this discussion of the domestic market. In addition, much of the information was obtained from a limited number of manufacturers and may not be representative of all manufacturers, particularly because each manufacturer produces a unique design.

2.3.1 Combustion Chamber Characteristics

The following combustion chamber characteristics distinguish the four major types of incinerators. The combustion chamber of hearth incinerators are non-moving units built with a grate or hearth in the primary chamber upon which solid wastes are burned. Liquid wastes may be injected in the primary or secondary chamber. Rotary kiln incinerators consist of a rotating cylindrical kiln in which solid wastes are incinerated and an afterburner to further oxidize the combustion gases. Liquid wastes may be incinerated in the kiln or the afterburner. Liquid injection incinerators are non-moving units in which liquid wastes are burned. There are no provisions to burn solid waste or to remove ash from the combustion chamber. Fluidized bed incinerators have a bed of sand suspended by air introduced under the bed, and a freeboard area above the bed in the combustion chamber. Liquid and shredded solid wastes are fed to the bed.

The following combustion chamber features of the four major types of incinerators are described in this section:

- Physical characteristics
- Refractory lining
- Waste loading system
- Ash handling system

Combustion chambers of hearth incinerators may be either vertically or horizontally oriented and cylindrical or rectangular in shape. Generally, the smaller units are vertical to occupy less space. Rectangular units often have primary and secondary chambers in the same steel shell divided by a refractory wall. Cylindrical units often have separate primary and secondary combustion chambers, with the secondary unit installed on top of the primary. Oil or gas burners are usually purchased by the manufacturers and installed in the secondary chambers. Burners may be installed in the primary chamber as an option. Hearth units equipped with a grate introduce combustion air both above and below the grate, termed overfire and underfire air, respectively, in order to promote combustion. Those units without grates generally use a hydraulic ram to push the solid waste along the floor of the hearth in order to ensure complete burning.

Refractories used in hearth incinerators are either castable or brick. Castable refractories are easier to install in small incinerators than brick. Three to five inches of low alumina refractory rated at 1900° to 2300°F are generally installed in the primary combustion chamber, insulated by at least two inches of firebrick. Three to five inches of alumina refractory rated at 2500° to 3200°F backed by two to three inches of insulating refractory are usually installed in the secondary chamber. As many as six different types of refractories may be used for the construction of a hearth unit. The combustion chamber shells encasing the refractory are either carbon steel or stainless steel, ranging from 12 gage to one quarter inch thickness. Combustion chamber heat release rates range from 15,000 Btu/hr-ft^3 to 25,000 Btu/hr-ft^3.

Waste loading systems to the hearth combustion chamber are usually hydraulic ram/hopper systems or cart dumping systems. It is generally not economical to install loaders on incinerators with capacities less than 200 pounds per hour (1.5 million Btu/hr). Typical waste loading system capacities range from 400 to 2400 pounds.

Ash removal systems usually employ a hydraulic ram or series of hydraulic rams to push the ash toward the opposite end of the combustion chamber from the charging door. The ash is conveyed to or dumped directly into a quench tank filled with water. Ash removal systems are economical to install on continuously operating incinerators with capacities greater than 500 pounds per hour.

Rotary kiln incinerators have at least two combustion chambers, the rotating or rocking kiln and an afterburner. Rotating kilns are horizontal and inclined slightly to facilitate ash and slag removal. The kilns rotate from one to seven revolutions per minute. Design heat release rates vary from 15,000 Btu/hr-ft^3 to 40,000 Btu/hr-ft^3. Heat release rates increase as incinerator capacities increase and the lower value of 15,000 Btu/hr-ft^3 is for small kilns incinerating wastes with high water content, such as wet sludges. Length to diameter ratios typically range from one to five. The outside diameters of rotary kilns are usually smaller than 15 feet, allowing them to be shipped by rail or truck and effectively limiting the heat input to approximately 75 million Btu/hr. Fuel burners are located in the kilns opposite the charging location and at the entrance to the afterburner.

Both castable and brick refractories are used in rotary kilns and afterburners. Castable refractories are usually used in small rotary kilns rated less than 6 million Btu/hr. Several types of brick refractory are used in a rotary kiln. The majority of a kiln is lined with two to four inches of insulating firebrick covered by six to ten inches of low temperature, highly erosion resistant firebrick. Severe refractory damage often occurs at the lower end of the kiln because of ash and slag falling into the ash pit and because of reflected heat from the afterburner. High temperature, highly erosion resistant firebrick is required for this application. Afterburners are most often lined with high temperature firebrick.

Waste loading systems to rotary kilns are often the most complex of all hazardous waste incinerator types. Solid, liquid, and containerized wastes are often fed to a rotary kiln simultaneously and liquid wastes may be injected to the afterburner. Sand or powerhouse ash may also be fed to the kiln to form a slag which protects the refractory from abrasion as long as the slag remains molten. Containers as large as 55 gallon drums may be fed through loaders equipped with air locks and hydraulic drum dumpers. Other loading systems include hoppers, screw feeders, hydraulic rams, lances or pipes for introducing sludges, and liquid injection nozzles and burners.

Some type of ash collection system is installed on rotary kilns because they are designed to incinerate wastes with high solids content. The ash systems include wet or dry bins, hoppers, and conveying systems.

Liquid injection incinerators are almost exclusively single chamber units that are either vertical or horizontal. Vertical units may be either upfired, so that the combustion gases exit at the top of the combustion chamber, or downfired. Many downfired units are equipped with a wet quench at the combustion chamber exit at the bottom of the unit, particularly for the incineration of wastes with high salt content. Typical heat release rates in the combustion chamber of liquid injection incinerators are approximately 25,000 Btu/hr-ft^3, and heat release rates as high as 1,000,000 Btu/hr-ft^3 may be achieved in the vicinity of the burners. Most liquid injection incinerator manufacturers also make burners. Fuel burners are usually maintained at low fire conditions during hazardous waste incineration in order to guarantee the presence of a flame. Low heating value wastes are often injected in the vicinity of a burner and high heating value wastes are incinerated through a burner. Length to diameter ratios of liquid injection units are 2:1 to 3:1 and diameters are usually less than 12 feet.

Castable and brick refractories are used in liquid injection units. No single type of refractory is preferred and the refractory material is often selected on the basis of waste characteristics. The minimum temperature rating of the refractory is approximately 2500^{o}F. Waste loading and ash removal systems are not necessary on liquid injection incinerators.

Fluidized bed incinerators are vertical and bed diameters range from 9 to 25 feet in diameter. The fluidized material is usually sand and bed thicknesses are 5 to 8 feet in the fluidized state.

Liquid and pulverized solid wastes are fed into the bed. Some waste destruction occurs in the bed and a flame is maintained in the freeboard area above the bed. Superficial gas velocities in the bed range from 2.5 to 8.0 feet per second, the lower value is applicable to wet wastes when volatilization of the water must occur in the bed. Fluidizing air is often preheated for improved thermal efficiency. Fluidized beds are single chamber incinerators although they are often equipped with ash drop chambers or cyclones immediately after the combustion chamber which effectively increase hot zone residence time. Both brick and castable refractories are used in the combustion chamber.

2.3.2 Incinerator Capacities

Typical incinerator design capacities and the ranges of capacities are presented in Table 6. Incinerator capacities are expressed as thermal input. The heating values of the incinerated wastes must be known to convert these values to mass input. For the purposes of this report, the incinerator manufacturing industry general estimates of 7000 Btu/lb for solid wastes and 10,000 Btu/lb for liquid wastes are used. Hearth incinerators have the smallest capacity of the four major types, ranging from 0.17 to 17.5 million Btu/hr, although rotary hearths can be constructed with capacities ranging from 25 to 170 million Btu/hr. Typical liquid injection and rotary kilns have approximately the same ranges of thermal capacities and, from the limited data available, fluidized beds have the

TABLE 6

THERMAL CAPACITIES OF HAZARDOUS WASTE INCINERATOR TYPES AS REPORTED BY MANUFACTURERS

Incinerator Type	Range 10^6Btu/hr	Statistical Value	Population	Typical Value 10^6Btu/hr
Liquid Injection	0.125 - 130	Median	50	8
Hearth	0.17 - 17.5	Average	48	4.9
Rotary Kiln	1 - 150	Median	34	10.3
Fluidized Bed	8.5 - 67	Average	5	45.5

greatest average capacity. Although the largest incinerator listed in Table 6 has a capacity of 150 million Btu/hr, some manufacturers have received requests to bid on facilities as large as 300 million Btu/hr. Such large facilities may have several primary combustion chambers ducted to a common secondary chamber.

2.3.3. Energy Recovery Equipment

Installation of energy recovery equipment on hazardous waste incinerators is governed primarily by economic considerations. About 90 percent of incinerator price quotations requested by prospective customers during the past six months specify energy recovery equipment. This is a significantly higher percentage than earlier quotations. Three factors that may preclude installation of energy recovery equipment are the economy of installations on small incinerators, the presence of corrosive flue gases, and presence of 'sticky' particulates in the flue gas. Sticky particulates occur when an incinerator is operated at temperatures higher than the ash fusion temperature. Generally, energy recovery on incinerators smaller than two to seven million Btu/hr may not be economical because of the relatively large capital cost of the equipment. Maintenance costs of equipment in highly corrosive atmospheres may be prohibitive.

Energy is most conveniently recovered as steam, which has several industrial uses such as the generation of electricity, the driving of process machinery, and heating. If no energy consumer is in the vicinity of an incinerator, installation of energy recovery equipment may not be economically feasible. Energy may also be recovered by transferring heat from the incinerator flue gas to incoming combustion air using a recuperator. Preheating combustion air improves combustion efficiencies and reduces auxiliary fuel consumption, but is less efficient than energy recovery using a boiler. Most incinerator manufacturers purchase energy recovery equipment to their specifications rather than fabricate the equipment.

Hazardous waste incinerators are generally equipped with either firetube or watertube boilers. In firetube boilers, the flue gases flow through tubes and water outside the tubes is heated to produce steam. Hot flue gases flow around water-filled tubes in the watertube boilers. For both types of boilers, flue gas temperatures of about 1800°F are maintained at the boiler inlet to reduce high temperature corrosion and plugging problems. Flue gases hotter than 1800°F are sometimes cooled by water or steam quenches, or air dilution. Exit flue gas temperatures are usually 500° to 550°F. Steam pressures from firetube boilers are generally less than 150 psi and steam pressures from watertube boilers are generally less than 250 psi. Energy recovery efficiencies of both boiler types are typically 60 to 80 percent of the heat content of flue gases.

Firetube boilers are generally installed on small incinerators and rarely exceed 15 million Btu/hr capacity because of design limitations. Most manufacturers will supply watertube boilers of any capacity. One manufacturer specifies firetube boilers if any HCl is present in the hot combustion gases.

The least expensive boiler design uses non-finned tubes and soot blowers to remove ash build-up. Fins may be added to the tubes in order to improve heat transfer if particulate concentrations in the combustion gas are less than 3 grains/dscf and no soft ash is present. Mechanical ash removal is a more efficient and expensive option than soot blowers. The production of steam at pressures greater than 250 psi requires specially fabricated boilers, which are more expensive than low pressure units. Another design feature is the installation of a radiation section prior to a tube heat exchanger for greater efficiency. Flue gas temperatures are reduced to 1000^{o}F in the radiation section and the exit temperatures from the tubes are typically 450^{o} to 500^{o}F. Pressure drops across energy recovery boilers are usually less than 4 inches water column (w.c.).

Several boiler modifications may be made to combat the corrosive effects of hydrochloric acid in the flue gas. The flue gas may be kept above the dew point of hydrochloric acid, which is about 350^{o}F, to reduce corrosion and below the temperature where high temperature corrosion starts, approximately 550^{o}F. The cooler end of the boiler may be epoxy coated or lined with high nickel alloys, such as Inconel and Hastelloy. Boiler tubes may be constructed of thicker metal in a corrosive atmosphere, for instance 10 gauge may be used instead of the usual 12 or 14 gauge. Another means of resisting corrosion is to clad the tubes with alloy sheathes.

2.3.4 Air Pollution Control Equipment

Several factors affect the installation of air pollution control equipment on hazardous waste incinerators, including:

- Federal, state, and local regulations regarding emissions
- Properties of the waste being incinerated
- Type of incinerator used
- Customer preference
- Equipment cost

Generally, both gaseous and particulate emissions are controlled, although some hazardous waste incinerators are not equipped with any air pollution control equipment. Air pollution control equipment is located downstream of any energy recovery equipment and can consist of one or more of the following components:

- Quench chamber
- Particulate collection device
    - Venturi scrubber
    - Baghouse
    - Electrostatic precipitator
    - Cyclone
    - Ionizing wet scrubber

- Gas absorbing device
  - Packed tower scrubber
  - Plate or tray scrubber
  - Spray tower scrubber
  - Ionizing wet scrubber
- Mist eliminator
- Flue gas handling equipment

Most hazardous waste incinerator manufacturers buy air pollution control equipment from vendors rather than manufacture the equipment.

The purpose of a quench chamber is to cool the flue gas in order for downstream air pollution control equipment to operate more efficiently. Water is sprayed into the flue gas, cooling it to adiabatic saturation temperature. The quench chambers may be constructed as independent units or they may be integrated with venturi scrubbers or gas absorbers. At flue gas volumetric flow rates of less than 2 million scfh in corrosive atmospheres, quench chambers are usually constructed of Inconel or Hastelloy. Stainless steel is subject to corrosion by hydrochloric acid and generally is not used. At higher flow rates, the quench chambers are rubber-coated carbon steel shells up to 12 or 14 feet in diameter lined with refractory. Quench chamber construction is single wall at flue gas temperatures less than 2100^{o}F and double wall at higher temperatures. Water flows between the double walls to cool the quench chamber and cascades into the hot flue gas zone.

Particulate removal devices are installed downstream from the quench chamber. The most common particulate removal device used on hazardous waste incinerators is the variable throat venturi scrubber equipped with a water spray, although several other devices such as baghouses and electrostatic precipitators have been used. Typical particulate loadings of incinerator flue gases are 1 grain/dscf, although concentrations up to 6 grains/dscf may be encountered, and generally 90 percent of the particles are less than 1 micron in diameter. Mechanical particulate removal devices, such as cyclones, are not efficient with such small particles and find limited application on hazardous waste incinerators. Venturi scrubbers are generally constructed of Inconel 625, fiber reinforced plastic (FRP), or Hastelloy C-276. The particulate removal efficiency of a venturi scrubber is a function of the pressure drop across the unit and the particle size distribution. Typical operating pressure drops range from 20 to 100 inches w.c. Several modifications of particulate collection devices have been developed to lower operating pressures. Ionizing chambers have been installed prior to a packed bed and these ionizing wet scrubbers are being installed on several new incinerator facilities.

Removal of gaseous pollutants is accomplished using gas-liquid contacting devices such as packed towers, spray towers and flooded tray towers. Some particulate removal occurs in these devices, although they are not designed for that function. Flue gases saturated with water at temperatures less than 190°F allow the use of FRP for construction. Alternatively, rubber or plastic lined steel may be used for construction, but the lining must be kept intact to prevent severe corrosion problems. The pH of the absorbing liquid is maintained at 6 to 8 by the addition of sodium hydroxide or lime to the recycle water. Several designs of water recycle systems exist and the primary purpose is to reduce the volume of wastewater that must be treated. Gas absorption equipment typically operates at pressure drops less than 9 inches w.c. and hydrogen chloride concentrations in the flue gas can be reduced to 20 ppm.

Mist eliminators for the separation of entrained water droplets from the flue gas exiting wet scrubbing equipment include cyclones, baffled separators, wire mesh, and fiber bed separators. Cyclone and baffled separators are capable of separating particles with diameters of 10 to 50 microns at operating pressure drops less than 1 inch w.c. Fiber bed mist eliminators are efficient collectors for droplets less than 10 microns in diameter, although they are subject to plugging and operate at pressure drops as high as 15 inches w.c. Wire mesh mist eliminators typically operate at less than 4 inches w.c. Wire mesh and baffled inertial devices are the most frequently used mist eliminators on hazardous waste incinerators.

The flue gas handling system associated with the air pollution control system consists of the following components:

- Breeching, dampers, and ducts
- Emergency and relief ducting

- Air moving equipment (blowers)
- Stack

High temperature ducts and breeching are usually refractory lined. Ducts installed downstream from a quench chamber and scrubbing system are usually acid resistant. High temperature ducting is required for any emergency venting, whether a relief stack with a damper or an emergency by-pass circumventing the air pollution control system is installed. Flue gas routing through the ducts is controlled by guillotine dampers or high temperature valves. Kilns and hearths may be equipped with a damper between the primary and secondary chambers, so that the secondary chamber may be isolated and used as a liquid injection unit.

Very few natural draft hazardous waste incinerators have been constructed recently and flue gases are usually exhausted through stacks using blowers. The two types of blowers used on hazardous waste incinerators are forced draft and induced draft blowers. Forced draft blowers feed combustion air at the front end of an incinerator and induced draft fans are installed at the back end of an incinerator overcoming the resistance caused by drawing flue gases from combustion chambers, through energy recovery and air pollution control equipment, in order to move the flue gases out the stack. Most incinerators employ induced draft blowers as the prime mover in order to maintain a slightly negative pressure in the combustion chambers. Smaller forced draft blowers are used to supply combustion air. Blowers are usually equipped with dampers to adjust air flow rates and control furnace draft. Blower rotors are generally made of Hastelloy and the parts contacting the flue gas are made of corrosion resistant materials, such as rubber coated steel, if the flue gas is acidic. Otherwise, carbon steel or fiberglass are the materials of construction. Blowers are often equipped with water sprays to reduce particulate buildup on the impellers.

Incinerator stacks are generally corrosion resistant, even on facilities equipped with air pollution control devices. Condensation can occur within stacks, particularly in cold climates, and concentrate small quantities of acid present in a flue gas. Corrosion resistant coatings applied to carbon steel stacks include epoxy resins, fiber reinforced plastic, and rubber. Alternatively, the entire stack may be constructed of fiber reinforced plastic. Stacks of incinerators not using a flue gas quench or wet scrubbing system are generally refractory lined. Stack gas reheaters and plume eliminators, which are essentially fuel burners installed in the stack, reduce condensation and visible steam plumes leaving the stack. Silencers can be placed between the stack and blower to reduce noise level.

2.4 Incinerator Operating Information

Incinerator manufacturers design hazardous waste units to operate at specific conditions depending on the type of incinerator and the waste characteristics. The most important operating conditions are the combustion zone temperature, combustion gas residence time at elevated temperature, and excess air usage. Typical operating conditions are summarized in Table 7. Hazardous waste incinerators may be designed to operate outside the ranges of these typical values. These data were obtained from a relatively small sampling of incinerator manufacturers and may not be indicative of the entire industry. Incinerator manufacturers often determine operating conditions from trial burns of a customer's waste.

2.4.1 Combustion Zone Temperatures

Liquid injection incinerators generally operate at higher combustion zone temperatures than the other types of incinerators because of the low excess air requirements. Liquid wastes are relatively easy to atomize and do not require large amounts of combustion air to ensure complete oxidation of solid wastes. Hazardous wastes containing organically bound chlorine are generally incinerated at temperatures higher than $2200^{\circ}F$. Aqueous wastes containing salts are seldom incinerated at temperatures higher than $1900^{\circ}F$ in order to prevent refractory damage.

Rotary kilns generally operate at lower combustion temperatures than liquid injection units and at approximately the same temperatures as hearth units. Wastes are volatilized in the kiln, and some combustion does occur in the kiln. The general practice in

TABLE 7

TYPICAL INCINERATOR OPERATING CONDITIONS AS REPORTED BY MANUFACTURERS

Incinerator Type	Combustion Zone Temperature (°F)	Combustion Gas Residence Time (Seconds)	Excess Air % Stoichiometric
Liquid Injection	1800-3000	0.3-2.0	120-250
Rotary Kiln	1200-2300	2 hr (solids)	50-250
Afterburner	2000-2500	1.0-3.0	120-200
Hearth			
Primary Chamber	1200-1800	---	30-200
Secondary Chamber	1400-2200	1.5-2.5	200-400
Fluidized Bed	1400-2000	1.0-5.0	100-150

this country has been to operate the kiln temperatures lower than the slagging temperature of steel when incinerating wastes in steel drums. European units are often operated above the steel slagging temperature and several recent kilns have been designed by American manufacturers to operate above the steel slagging temperature, (between 2400°F and 2800°F, depending on eutectic materials present in the waste). Afterburner temperatures are correspondingly higher for steel slagging units. Liquid and gaseous wastes are often incinerated in the afterburner to provide the necessary thermal input that might otherwise be provided by auxiliary fuel.

Hearth and fluidized bed incinerators have not been designed to operate under steel slagging conditions. Combustion zone temperatures are relatively low because high excess air is used to ensure turbulence. Turbulence is attained in fluidized beds through contact between the waste and the bed particles. The high turbulence permits oxidation at relatively low combustion zone temperatures in fluidized beds.

2.4.2 Residence Time

Residence time may be defined as the time a parcel of combustion gas remains at the combustion zone temperature. Residence times cannot be measured directly and are most often estimated from the combustion gas volume flow rate at combustion zone conditions and the combustion chamber volume. In fact, the design residence time is attained by adjusting the size of the secondary combustion chamber of kilns and hearths and the primary chamber of liquid injection and fluidized bed units. Gas residence times in rotary kilns and the primary chamber of hearths are usually not included in residence time computation. Solids retention times in these chambers are designed to obtain sufficient burnout of the ash.

Incinerator manufacturers have used several methods to increase residence times and turbulence in the combustion chamber. The most common method is to induce cyclonic flow by the design and location of waste and fuel burners. Baffles and mixing chambers are also used to promote turbulence. The effectiveness of the various methods must be evaluated from performance tests of the entire incineration system.

2.4.3 Excess Air Usage

Excess air usage varies widely among incinerator manufacturers. The amount of excess air is usually minimized if energy recovery equipment is installed in order to ensure the maximum temperature difference between the heat exchanger inlet and outlet and, therefore, the highest energy recovery efficiencies. Liquid injection incinerators always operate with an excess of air, generally 20 to 60 percent in excess of stoichiometric air requirements. The only exception is the incineration of organic wastes containing nitrogen, when two chamber incinerators are used. The primary chamber is operated under starved air conditions (less than stoichiometric air) to minimize the formation of nitrogen oxides.

Organics are oxidized in the presence of excess air in the secondary chamber. Liquid injection incinerators may operate under slightly positive pressure if a forced draft blower is used, or slightly negative combustion chamber pressures if an induced draft blower is used. In either case, pressure differentials in the combustion chamber are generally less than two inches water column from atmospheric pressure.

The primary chamber of rotary kiln incinerators may be operated either in a starved air or excess air mode. Generally, smaller rotary kilns (5 to 20 million Btu/hr) are operated in a starved air mode, and the larger units are always operated using excess air. Because rotary kilns incinerators are always equipped with an oxidizing secondary combustion chamber, there is always overall excess air usage. Rotary kilns operate at a slight vacuum (less than two inches water column) in the combustion chambers, maintained by an induced draft blower. As a result, air may enter through charging doors, seals, and ports as well as combustion air forced draft blowers. Allowances for air entering through leaks are incorporated in kiln designs. Similarly, hearth incinerators commonly operate under starved air conditions in the primary chamber and with excess air in the secondary chamber. Overall excess air usage ranges from 30 to 100 percent. Hearth incinerators require higher excess air usage than rotary kilns to ensure turbulence. The rotation of the kiln agitates the waste to improve turbulence.

Methods used to agitate solid wastes in hearths and promote turbulence include the use of reciprocating grates, rakes over the grates, and hydraulic rams to push the waste along the hearth. Combustion air may enter the incinerator both above and below the hearth and combustion chamber pressures are usually slightly negative.

Fluidized bed incinerators are able to operate at very little excess air because of the excellent mixing of air and waste in the bed. The majority of the air entering the incinerator is used to fluidize the bed. Some air is introduced in the headspace above the bed in order to ensure complete oxidation. Negative combustion chamber pressures are usually maintained at less than one inch water column.

3.0 PROFILE OF EXISTING HAZARDOUS WASTE INCINERATION FACILITIES

This section contains a summary of the numbers, types, and characteristics of hazardous waste incineration systems in use in the United States based on information obtained from the owners and operators of incineration facilities.

3.1 Data Collection Effort

Information about current hazardous waste incineration practices was obtained for two purposes, specifically:

- Loading of the Hazardous Waste Control Technology Data Base (HWCTDB)
- Development of a regulatory impact analysis (RIA) of the EPA hazardous waste incineration standards.

The HWCTDB is an automated data management storage and retrieval system designed to store comprehensive design, operating, and performance data on facilities using thermal processes to destroy hazardous wastes. Additional information on the HWCTDB may be found in "Recommended Structure, Content, and Data Formats for a Hazardous Waste Control Technology Data Base," (Holberger, 1981) and in the "HWCTDB System Documentation," (CSC Corporation, 1982).

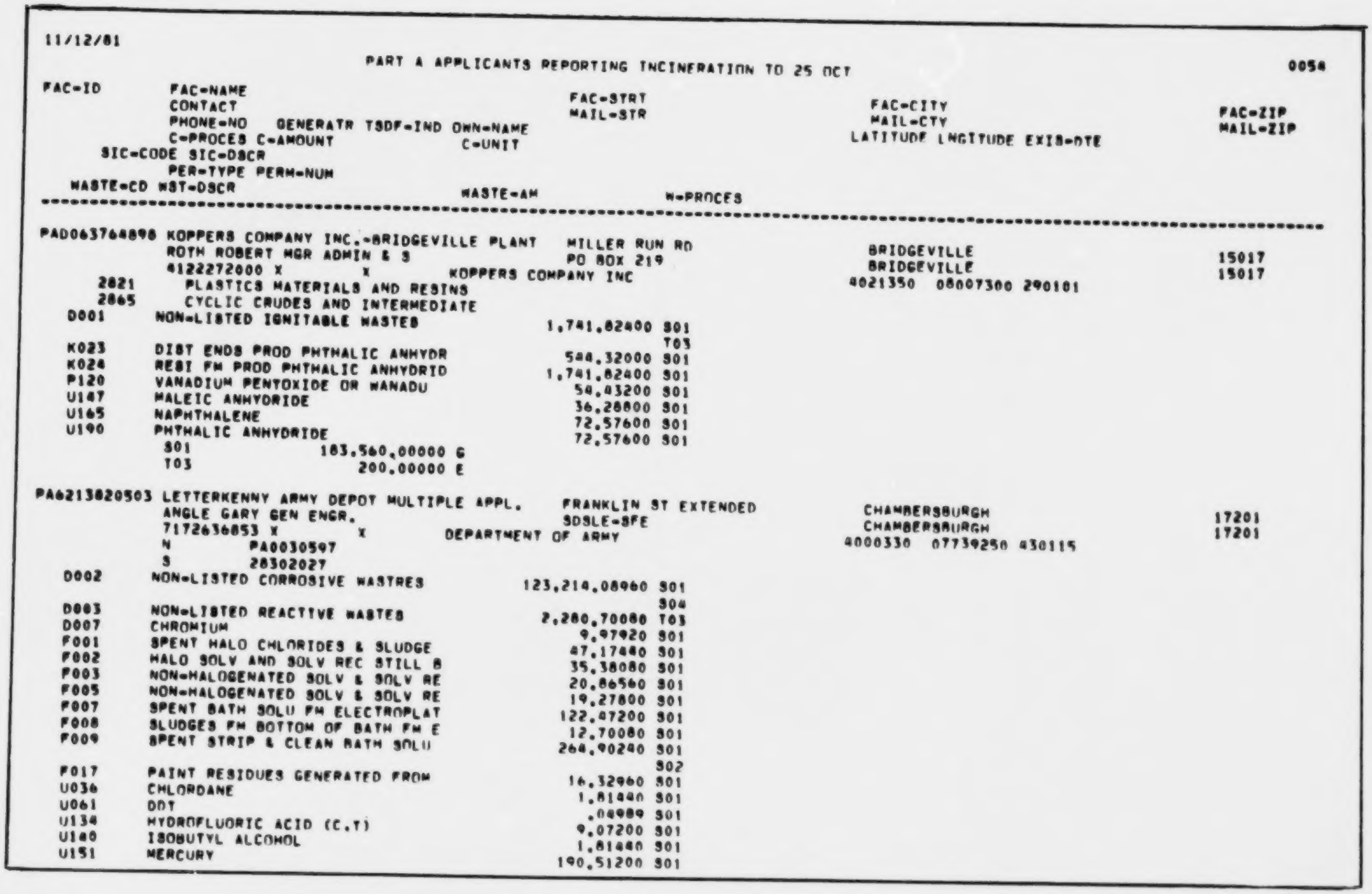
The EPA Office of Solid Waste (OSW), charged with developing the RIA for the incineration standards, identified specific data requirements for the development of an industry profile, on which they were to base their RIA. The data needs identified by OSW consisted of a subset of the data elements contained in the HWCTDB.

Since the RIA needs were pressing, emphasis in the data collection effort was on contacting all current hazardous waste incineration facilities to obtain the basic data needed for the RIA, rather than contacting a smaller number of facilities to obtain more comprehensive data for filling out the data base.

3.1.1 Identification of Facilities

Regulations promulgated under the Resource Conservation and Recovery Act (RCRA) require all hazardous waste treatment, storage, or disposal facilities to apply for a permit to continue operations. Part A of the permit process consists of submission of EPA Form 3510-1, titled "Form 1, General Information" (80FR33555 and 33556, 19 May 1980) and EPA Form 3510-3, titled "Form 3, RCRA Hazardous Waste Permit Application" (80FR33584-33588, 19 May 1980). Information from these two forms has been compiled and stored in the automated Hazardous Waste Data Management System (HWDMS).

A retrieval of all facilities applying for an incineration permit formed the basic list of incineration facilities for this study. A typical retrieval of Part A information for one of these facilities is shown in Figure 1. The basic list was augmented with the names of other facilities identified as potential sites of hazardous waste incinerators based on published documentation, information in EPA and state regulatory agency files, and on the personal knowledge of MITRE staff members. As of the 30 November 1981 cutoff date established by OSW/MITRE agreement, 566 facilities



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11/12/81
                                     PART A APPLICANTS REPORTING INCINERATION TO 25 OCT                                          0054
FAC-ID      FAC-NAME
            CONTACT                                       FAC-STRT                      FAC-CITY                       FAC-ZIP
            PHONE-NO   GENERATR TSDF-IND OWN-NAME         MAIL-STR                      MAIL-CTY                       MAIL-ZIP
            C-PROCES C-AMOUNT                  C-UNIT                                LATITUDE LNGITUDE EXIS-DTE
    SIC-CODE SIC-DSCR
            PER-TYPE PERM-NUM
  WASTE-CD WST-DSCR                            WASTE-AM                W-PROCES
---------------------------------------------------------------------------------------------------------------------------------

PAD063764898 KOPPERS COMPANY INC.-BRIDGEVILLE PLANT   MILLER RUN RD                   BRIDGEVILLE                    15017
            ROTH ROBERT MGR ADMIN & 3                 PO BOX 219                      BRIDGEVILLE                    15017
            4122272000 X          X        KOPPERS COMPANY INC                     4021350  08007300 290101
      2821     PLASTICS MATERIALS AND RESINS
      2865     CYCLIC CRUDES AND INTERMEDIATE
  D001      NON-LISTED IGNITABLE WASTES                  1,741,82400 S01
                                                                 T03
  K023      DIST ENDS PROD PHTHALIC ANHYDR                 544,32000 S01
  K024      RESI FM PROD PHTHALIC ANHYDRID               1,741,82400 S01
  P120      VANADIUM PENTOXIDE OR WANADU                    54,43200 S01
  U147      MALEIC ANHYDRIDE                                36,28800 S01
  U165      NAPHTHALENE                                     72,57600 S01
  U190      PHTHALIC ANHYDRIDE                              72,57600 S01
             S01           183,560,00000 G
             T03                200,00000 E

PA6213820503 LETTERKENNY ARMY DEPOT MULTIPLE APPL.    FRANKLIN ST EXTENDED            CHAMBERSBURGH                  17201
            ANGLE GARY GEN ENGR.                      SDSLE-SFE                       CHAMBERSBURGH                  17201
            7172636853 X          X        DEPARTMENT OF ARMY                      4000330  07739250 430115
            N          PA0030597
            S          28302027
  D002      NON-LISTED CORROSIVE WASTRES               123,214,08960 S01
                                                                 S04
  D003      NON-LISTED REACTIVE WASTES                   2,280,70080 T03
  D007      CHROMIUM                                         9,97920 S01
  F001      SPENT HALO CHLORIDES & SLUDGE                   47,17440 S01
  F002      HALO SOLV AND SOLV REC STILL B                  35,38080 S01
  F003      NON-HALOGENATED SOLV & SOLV RE                  20,86560 S01
  F005      NON-HALOGENATED SOLV & SOLV RE                  19,27800 S01
  F007      SPENT BATH SOLU FM ELECTROPLAT                 122,47200 S01
  F008      SLUDGES FM BOTTOM OF BATH FM E                  12,70080 S01
  F009      SPENT STRIP & CLEAN BATH SOLU                  264,90240 S01
                                                                 S02
  F017      PAINT RESIDUES GENERATED FROM                   16,32960 S01
  U036      CHLORDANE                                        1,81440 S01
  U061      DDT                                               ,04989 S01
  U134      HYDROFLUORIC ACID (C,T)                          9,07200 S01
  U140      ISOBUTYL ALCOHOL                                 1,81440 S01
  U151      MERCURY                                        190,51200 S01
```

FIGURE 1

A DATA SET RETRIEVED FROM HWDMS FOR A TYPICAL HW INCINERATION FACILITY were listed in HWDMS as hazardous waste incineration facilities. An additional 46 facilities were identified from other sources, yielding a list of 612 facilities potentially operating one or more hazardous waste incinerators. This list of facilities is given in Appendix B.

3.1.2 Data Collection Procedures

Data collection for the HWCTDB was initially envisioned as a two-phase effort. The facilities were to be contacted by telephone to determine whether voluntary cooperation with the project could be expected, and if a site visit could be arranged. Detailed information would be obtained during such visits. This procedure was modified shortly after implementation because of the urgency of the data needs for the RIA. All 612 facilities were contacted by telephone in order to verify the accuracy of the Part A permit application information and to obtain the additional limited amount of data necessary for the RIA. A sample of the telephone log sheet prepared to record each telephone conversation is reproduced in Appendix C.

The telephoning chores were divided between MITRE and Acurex Corporation of Mountain View, California to expedite the task. MITRE contacted approximately 450 facilities in the eastern United States and Acurex contacted approximately 150 facilities in the west. The completed log sheets were submitted to EPA, OSW and the data obtained from the calls are summarized in the following section.

3.2 Data Summary

Information obtained from the owners and operators of hazardous waste facilities is summarized in the following 36 Tables. The tables are divided into five groups to simplify discussion of the data, specifically:

- Existence and general characteristics of hazardous waste incinerators (Tables 8 through 14)
- Incinerator capacities and operating information (Tables 15 through 24)
- Waste characteristics (Tables 25 through 35)
- Installation of air pollution control and energy recovery equipment (Tables 36 through 40)
- Thermal destruction of hazardous wastes in devices other than incinerators (Tables 41 through 43)

A list of the 612 incineration facilities is provided in Appendix B, with some of the data summarized in the first group of tables. The following discussion explains the derivation and significance of the data summaries.

3.2.1 General Facility Characteristics

Table 8 summarizes the status of facilities which were identified as potential sites of hazardous waste incinerators. The table gives the count of facilities which verified having an operational incinerator and (since several facilities operated more than one unit) the total number of incineration systems. Unless otherwise stated in this report, combination incinerators, such as a rotary kiln and liquid injection unit in series or feeding a common

TABLE 8

STATUS OF HAZARDOUS WASTE INCINERATOR FACILITIES IN EACH EPA REGION

Region	**Operational HWI Facilities**	**Number of Incinerators**	Facilities with No Operational HWI	Number of Facilities with HWI Under Construction	**Status Unknown**	**Sample Size**
I	10	12	34	3	1	48
II	22	28	46	4	1	73
III	23	30	48	5	0	76
IV	46	59	52	6(a)	0	102
V	29	31	44	3	0	76
VI	62	95	28	4(a)	0	93
VII	8	8	11	3	0	22
VIII	5	5	9	1	1	16
IX	14	16	14	3	0	31
X	0	0	0	0	0	0
Total	219	284	286	32(a)	3	537

(a) = 3 facilities have both an operational unit and a unit under construction; 2 in Region IV and 1 in Region VI.

afterburner are counted as one incineration system. Operational HW incinerators are defined as those currently burning hazardous waste or which are "temporarily" shut down for maintenance or other causes. Standby units are classified as operational.

The sample size of 537 facilities is less than the list of 612 facilities in Appendix B. The primary reason for the smaller sample size is that many facility representatives would not divulge any information to a contractor without a letter from EPA and/or internal corporate approval. Because no data were obtained from these facilities, they are not represented in the data summaries. The "status unknown" column in Table 8 refers to facility spokesmen who acknowledged the presence of a hazardous waste incinerator at the facility, but would not provide any additional information. Approximately ten facilities could not be contacted.

Of the 537 facilities providing information, 219 reported having an operational hazardous waste incinerator, with an additional 32 incinerators under construction. Several reasons exist for the poor correlation of the number of facilities reporting incinerators and the number who submitted Part A applications, including:

- The facility may have some other type of thermal treatment system such as a fume oxidizer, boiler, trash incinerator, or process kiln that was erroneously reported as an incinerator on the Part A
- The facility may be planning to install a hazardous waste incinerator

- The facility owner may have misinterpreted the application form and indicated the presence of an incinerator when the waste is actually shipped off-site for incineration at another facility

- Typographical and computer data entry errors.

Both the numbers of facilities and incinerators are significantly less than earlier estimates of the HW incinerator population made by OSW. In early 1981, OSW made a random survey of 1200 of the approximately 14,000 Part A applications submitted. The survey indicated that 73 of the 1200 facilities reported HW incinerators. Extrapolation of this response would indicate a total of 852 incineration facility permit applicants, with a range of 686 to 1065 facilities at the 95 percent confidence level.

Because of the difference of these incinerator estimates and incomplete data entry in the HWDMS as of November 1981, the data base was reviewed at the conclusion of this project in July 1982. Several incineration facilities had been deleted from the data base in accordance with the findings of this survey, but, more significantly, a large number of additional facilities had been added. These changes are detailed in Tables B-1 and B-2 in Appendix B. Of the 608 facilities listed in the HWDMS as of July 1982, 128 had not been contacted during this study. If the same percentage of these 128 facilities is assumed to have incinerators as found in this current survey (41 percent), an additional 52 facilities would have 68 incinerators. Therefore, based on the July 1982 data, it may be estimated that there were 352 operational hazardous waste incinerators at 271 facilities in the United States. This estimate agrees very well with the incinerator population of 342 derived from the incinerator manufacturers survey.

Table 9 presents a State and EPA Regional distribution of operational HWI facilities. Although none of the data in this report was subjected to formal statistical treatment, inspection of the geographical data in this table shows an apparent correlation of the number of HWI facilities with known chemical industry centers. Texas and Louisiana report 52 (18 percent) of the incinerator facilities. Other industrialized states with a large number of facilities include New York (12), California (10) and North Carolina (10). Large areas of the west have few incinerators and EPA Region X has no HW incineration facilities.

Table 10 lists the number of facilities reporting HW incinerators under construction or in planning. Thirty-two facilities reported having an incinerator under construction or completed but not yet operational. Three of these facilities already have another HW incinerator in operation. Eleven facilities have an incinerator actively planned and thirteen have some type of remote plans to install an incinerator. This latter type of planning is usually very uncertain and subject to change depending on the economic and regulatory climate locally and nationally. Nineteen facilities that reported HW incineration on their Part A said they

TABLE 9

NUMBER OF OPERATIONAL HWI FACILITIES IN EACH STATE*AND EPA REGION

Region/ State	No.	Region/ State	No.	Region/ State	No.	Region/ State	No.	Region/ State	No.
I/CT	5	II/NJ	6	III/DE	2	IV/AL	7	V/IL	9
ME	1	NY	12	DC	0	FL	7	IN	5
MA	3	PR	4	MD	4	GA	6	MI	2
NH	0	VI	0	PA	9	KY	4	MN	2
RI	1			VA	2	MS	1	OH	6
VT	0			WV	6	NC	10	WI	5
						SC	4		
						TN	7		
Total	10		22		23		46		29
VI/AR	6	VII/IA	3	VIII/CO	4	IX/AZ	1	X/AK	0
LA	21	KS	1	MT	0	CA	10	ID	0
NM	1	MO	2	ND	0	HI	2	OR	0
OK	3	NE	2	SD	0	NV	1	WA	0
TX	31			UT	1				
				WY	0				
Total	62		8		5		14		0

TOTAL: 219 Facilities

---

*Including Puerto Rico, Virgin Islands and Washington, D.C.

TABLE 10

NUMBER OF HW INCINERATORS UNDER CONSTRUCTION OR PLANNED

Number Under Construction(a)	32
Number Actively Planned(a)	11
Number Remotely Planned(a)	13

(a) Definitions:

Under Construction:	Any unit for which a construction contract has been signed, which is under construction, or which is completed but not yet operational.
Actively Planned:	In pre-construction planning stage.
Remotely Planned:	Decision to obtain incinerator in the future is under consideration.

were planning an incinerator but have changed plans, or they had an operational unit which has subsequently been shut down. In most cases, the decision to change plans was the result of many factors. However, two of the companies specifically cited the RCRA regulations as influencing the corporate decision.

Table 11 shows the commercial status of HW incineration facilities in each EPA region. A commercial facility is defined as any facility which engages in the business of HW incineration. A private facility is defined as any non-governmental, non-commercial facility. The data shows that 175 of the 219 respondents (approximately 80%) are private operations. Of the other 44 facilities, 28 were commercial operations and 15 were government operations. One facility was private but accepted wastes from other generators. However, the spokesman for this facility was not certain how long this practice would continue since the economics and logistics of the operation were becoming unfavorable. Most of the government facilities are engaged in either ammunition production or obsolete ammunition disposal. Such incinerators are usually special purpose units designed or fabricated to contain the forces released during the incineration of the material. There is no obvious distinction between the geographical distribution of the private versus commercial incinerators.

Table 12 shows the number of research facilities (typically universities or chemical laboratories) in each EPA region which

TABLE 11

COMMERCIAL STATUS OF HW INCINERATION FACILITIES

EPA Region	Private(a)	Commercial Incineration(b)	Private With Some Commercial Incineration	Government(c)	Respondents Per Region
I	8	1	0	1	10
II	20	2	0	0	22
III	19	3	0	1	23
IV	32	9	1	4	46
V	24	4	0	1	29
VI	53	6	0	3	62
VII	7	1	0	0	8
VIII	3	0	0	2	5
IX	9	2	0	3	14
X	0	0	0	0	0
Respondents Per Category	175	28	1	15	219

(a) Includes universities.
(b) Any facility which engages in the business of HW incineration.
(c) Includes Federal (military and non-military), State and local government facilities.

TABLE 12

NUMBER OF RESEARCH FACILITIES AND INCINERATION RESEARCH FACILITIES IN EACH EPA REGION

Region	Research Facilities[a]	Incineration Research[b]
I	0	1
II	1	0
III	5	1
IV	1	0
V	2	1
VI	5	1
VII	2	0
VIII	1	0
IX	2	0
X	0	0
Total	19	4

(a) Any facility engaged in research and development and typically generating small quantities of a wide variety of hazardous wastes.

(b) Any facility engaged in research and development of incinerators or incineration techniques. Also includes vendor demonstration units.

reported operating a HW incinerator. The table also shows the number of facilities that reported operating a HW incinerator for incineration research purposes. Most of the research facilities have small incinerators and burn a variety of laboratory wastes in small quantities. The actual number of research facilities incinerating hazardous wastes may be much higher than shown because many such facilities may be exempted as small generators, and thus, were not required to submit permit applications. Many of these units operate on an intermittent schedule or only on an as needed basis. The four incineration research facilities were all operated by incinerator manufacturers. One manufacturer reported six incineration units available for demonstration or test burning of customer's wastes.

Table 13 shows the geographical distribution by EPA Region of the various types of HW incinerators. The types of incinerators are defined as follows:

> Liquid Injection - an incinerator that uses an atomization device or nozzle to feed only liquid wastes.
>
> Fume with Liquid Capability - an incinerator principally used for burning of vapors which has an atomization device or nozzle for burning of liquid waste.
>
> Hearth with Liquid Capability - any fixed hearth or chamber designed for the introduction of bulk waste but equipped with an atomization device or nozzle for burning of liquid waste.
>
> Hearth (solids only) - any fixed hearth or chamber dedicated for incineration of solids and not equipped for the injection of liquid waste.

TABLE 13

TYPE OF HW INCINERATORS IN EACH EPA REGION

Type	EPA Regions										Total
	I	II	III	IV	V	VI	VII	VIII	IX	X	
Liquid Injection	7	15	12	23	16	57	2	—	4	—	136
Hearth with Liquid Capability	—	1	4	8	4	10	2	3	1	—	33
Fume with Liquid Capability	—	—	2	10	—	6	1	—	5	—	24
Rotary Kiln with Liquid Capability	—	2	—	4	1	3	—	—	—	—	10
Combination System[a]	—	1	—	—	2	2	—	—	—	—	5
Rotary Kiln (Solids only)	—	—	—	1	—	—	—	—	—	—	1
Hearth (Solids only)	1	3	8	1	2	6	1	—	1	—	23
Ammunition and Explosives (Military)	—	—	1	2	—	4	—	2	2	—	11
Ammunition and Explosives (Non-Military)	—	—	—	1	—	—	—	—	—	—	1
Drum Burner	—	1	—	4	1	1	—	—	—	—	7
Other	4	2	1	2	1	1	1	—	1	—	13
Type Not Specified	—	3	2	3	4	5	1	—	2	—	20
Total	12	28	30	59	31	95	8	5	16	0	284

(a) Includes interconnected multiple units (e.g., hearth connected in series with liquid injection unit).

Rotary Kiln with Liquid Capability - a rotating, cylindrical incinerator equipped with an atomization device or nozzle for burning of liquid waste in the rotating chamber.

Rotary Kiln - any rotary kiln dedicated to solid wastes and not equipped for the injection of liquid waste into the rotating chamber.

Combination System - any combination of connected incinerator types intended to operate as a single system.

Ammunition and Explosives - any incinerator primarily used for the destruction of ammunition, explosives or related wastes which are not otherwise classified as hazardous.

Drum Burner - any incinerator specifically used for the reclamation or reconditioning of steel drums.

Other - all HW incinerators not included in any of the above categories. The 13 units identified were: fludized bed (4), metal recovery (3), liquid flares (2), research prototypes (2), pyrolizer (1), and car bottom annealing furnace (1).

The liquid injection incinerator is the most prevalent type, accounting for 52 percent of the 264 incinerators identified by type. The sum of the four types of incinerators with liquid injection capability is 79 percent of the total.

Table 14 shows the age distribution of the various types of HW incinerators. The table shows that approximately 80 percent of all units are less than 10 years old and 50 percent are 6 to 10 years old.

3.2.2 Incinerator Capacities and Operating Characteristics

The capacities of liquid injection incinerators are indicated in Tables 15 and 16. Table 15 lists the incinerator population distribution as a function of capacity. Liquid waste capacity was

TABLE 14

TYPES OF HW INCINERATORS vs AGE OF INCINERATOR

Incinerator Type	Age Range (Years)					
	0-2	3-5	6-10	>10	Unknown	Total
1. Liquid Injection	13	11	36	14	62	136
2. Hearth with Liquid Capability	1	1	7	-	24	33
3. Fume with Liquid Capability	3	1	2	1	17	24
4. Rotary Kiln with Liquid Capability	2	-	1	-	7	10
5. Combination System[a]	1	-	1	1	2	5
6. Rotary Kiln (Solids only)	1	-	-	-	0	1
7. Hearth (Solids only)	4	2	7	-	10	23
8. Ammunition and Explosives (Military)	-	1	-	3	7	11
9. Ammunition and Explosives (Non-Military)	-	-	-	1	0	1
10. Drum Burner	-	-	4	2	1	7
11. Other[b]	3	-	2	2	6	13
12. Type Not Specified	-	-	-	-	20	20
Total	28	16	60	24	156	284

(a) Includes interconnected multiple units (e.g., hearth connected in series with liquid injection unit).

(b) Includes such items as fluidized bed incinerators.

TABLE 15

CAPACITY OF HW INCINERATORS BURNING LIQUID WASTES

Capacity (Gallons/Hour)	Number of Incinerators	Cumulative Number
0 - 50	48	48
51 - 100	28	76
101 - 200	22	98
201 - 300	22	120
301 - 500	12	132
501 - 1000	23	155
1001 - 2000	17	172
2001 - 5000	4	176
5001 - 10,000	4	180
Unknown	28	208

TABLE 16

CAPACITY OF HW INCINERATORS BURNING LIQUIDS vs TYPE OF INCINERATOR

Type of Incinerator		Capacity (Gallons Per Hour)									
		0-50	51-100	101-200	201-300	301-500	501-1000	1001-2000	2001-5000	5001-10000	Unknown
Liquid Injection	Number	37	13	15	16	9	20	6	2	4	14
	Cumulative Number	37	50	65	81	90	110	116	118	122	136
Hearth or Chamber Liquid	Number	6	5	5	4	1	0	3	2	0	7
	Cumulative Number	6	11	16	20	21	21	24	26	26	33
Fume/Liquid	Number	3	10	1	2	1	1	2	0	0	4
	Cumulative Number	3	13	14	16	17	18	20	20	20	24
Rotary/Liquid	Number	1	0	1	0	1	1	5	0	0	1
	Cumulative Number	1	0	2	0	3	4	9	0	0	10
Combination System[(a)]	Number	1	0	0	0	0	1	1	0	0	2
	Cumulative Number	1	1	1	1	1	2	3	3	3	5
Total Liquid	Number	48	28	22	22	12	23	17	4	4	28
	Cumulative Number	48	76	98	120	132	155	172	176	180	208

(a) Liquid capacity of Combination Systems.

specified for 180 of the 208 liquid waste incinerators. The median capacity is 150 gallons per hour; 27 percent of the liquid injection incinerators burn less than 50 gallons per hour; and 14 percent of the incinerators reported capacities greater than 1000 gallons per hour. The capacity distribution of the various types of liquid injection incinerators is presented in Table 16. Fume incinerators with liquid injection capabilities have the smallest median liquid waste capacity, less than 100 gallons per hour.

The capacity distribution of solid waste incinerators is presented in Table 17 and developed as a function of incinerator type in Table 18. If non-hazardous solid waste is incinerated with hazardous solid waste, the total design capacity of the incinerator is reported. Solid waste capacities were reported for 44 of the 61 solid waste incinerators. The median capacity of solid waste incinerators is approximately 650 pounds per hour, equivalent to approximately 78 gallons per hour of aqueous wastes. The median capacity of hearth incinerators is generally less than that of other units, at approximately 500 pounds per hour.

Table 19 shows the utilization time for the 219 incinerators for which such data was reported. Only 71 incinerators (32 percent) reported continuous operation. Some units reported continuous operation, but on a seasonal or production dependent basis. These units are tabulated under the appropriate partial time category.

TABLE 17

CAPACITY OF HW INCINERATORS BURNING SOLID WASTES

Capacity (Pounds/Hour)	Number of Incinerators	Cumulative Number
0 - 100	4	4
101 - 300	5	9
301 - 500	7	16
501 - 1000	12	28
1001 - 2000	6	34
2001 - 5000	7	41
5001 - 10,000	1	42
10,001 - 20,000	2	44
Unknown	17	61

TABLE 18

CAPACITY OF HW INCINERATORS BURNING SOLIDS vs TYPE OF INCINERATOR

Type of Incinerator		Capacity (Pounds Per Hour)								
		0-100	101-300	301-500	501-1000	1001-2000	2001-5000	5001-10000	10001-20000	Unknown
Combination System[a]	Number	0	0	0	1	2	0	0	1	1
	Cumulative Number	0	0	0	1	3	3	3	4	5
Rotary Kiln, Solids Only	Number	1	0	0	0	0	0	0	0	0
	Cumulative Number	1	1	1	1	1	1	1	1	1
Hearth or Chamber Solids	Number	2	4	5	3	3	2	0	1	3
	Cumulative Number	2	6	11	14	17	19	19	20	23
Subtotal	Number	3	4	5	5	3	3	0	3	3
	Cumulative Number	3	7	12	17	20	23	23	26	29
Other Types[b]	Number	1	1	2	8	1	5	1	0	13
	Cumulative Number	1	2	4	12	13	18	19	19	32
Total Solid	Number	4	5	7	12	6	7	1	2	17
	Cumulative Number	4	9	16	28	34	41	42	44	61

(a) Solids capacity of Combination Systems.

(b) Other Types includes such items as ammunition and explosives incinerators, drum burners, and fluidized bed incinerators.

TABLE 19

UTILIZATION TIME FOR HW INCINERATORS

Percentage of Time Unit is Operational(1)	Number Reported	Percent of Total Reported
0(2)	13	6
Intermittent(3)	13	6
0-9	32	15
10-29	49	22
30-59	22	10
60-99	19	9
100(4)	71	32
Total Reporting	219	100

(1) = Partial operation generally implies some operation each week or month. However, some units reported extended periods of continuous operation followed by extended periods of shut-down.

(2) = Unit is on standby or down for maintenance.

(3) = Intermittent refers to sporadic operation generally with low total usage.

(4) = 24 hours per day, 7 days per week, except for maintenance.

Incinerators connected to manufacturers process streams, especially fume/liquid incinerators, are more likely to be operated on a continuous basis.

Table 20 shows the distribution of maximum combustion zone temperatures for 173 incinerators for which data was provided. Table 21 presents temperature data by type of incinerator. The median temperature range for all incinerators is in the 1700-1800°F slightly higher than that of all incinerators at approximately 1800°F. Fifteen (65 percent) of the 23 units for which reported temperatures exceeded 2200°F were of the liquid injection type. Fume incinerators with liquid injection capability have the lowest median temperature (approximately 1500°F and 14 of the 20 units were reported to operate at temperatures of 1600°F or less. These combustion zone temperatures reflect the amount of excess air introduced into the different types of incinerators. The liquid injection units usually operate at lower excess air rates than fume or solid units. If other factors are held constant, higher excess air usage produces a lower chamber temperature.

other factors are held constant, higher excess air usage produces a lower combustion chamber temperature.

Table 22 shows the distribution of gaseous residence times for 104 incinerators and Table 23 shows this data by type of incinerator. Residence time data were provided for only 37 percent of the

TABLE 20

MAXIMUM COMBUSTION ZONE TEMPERATURE OF HW INCINERATORS

Range °F	Number of Incinerators
<1600°F	36
1600° - 1900°F	64
1901° - 2200°F	50
>2200°F	23
Sample Size	173

TABLE 21

HW INCINERATOR TYPE vs MAXIMUM COMBUSTION ZONE TEMPERATURE

Incinerator Type	Temperature										
	>2200	2101 - 2200°F	2001 - 2100°F	1901 - 2000°F	1801 - 1900°F	1701 - 1800°F	1601 - 1700°F	1501 - 1600°F	≤1500°F	Unknown	Total
1. Liquid Injection	15	8	8	10	4	17	7	9	11	47	136
2. Hearth with Liquid Capability	-	-	3	3	4	6	-	2	4	11	33
3. Fume with Liquid Capability	2	1	1	-	-	1	1	5	9	4	24
4. Rotary Kiln with Liquid Capability	2	-	1	-	-	1	-	2	-	4	10
5. Combination System(a)	1	-	1	1	1	-	-	-	-	1	5
6. Rotary Kiln (Solids only)	-	-	-	-	-	1	-	-	-	-	1
7. Hearth (Solids only)	2	2	2	4	-	1	2	-	4	6	23
8. Ammunition and Explosives (Military)	-	-	-	3	-	-	-	-	-	8	11
9. Ammunition and Explosives (Non-Military)	-	-	-	-	-	-	-	-	-	1	1
10. Drum Burner	-	-	-	1	-	1	-	1	2	2	7
11. Other(b)	1	-	1	-	-	-	-	1	3	7	13
12. Type Not Specified	-	-	-	-	-	-	-	-	-	20	20
Total	23	11	17	22	9	28	10	20	33	111	284

Note: For the 284 incinerators for which data were gathered, only 173 had combustion zone temperatures available.

(a) Inclues interconnected multiple units (e.g., hearth connected in series with liquid injection unit).

(b) Includes such items as fluidized bed incinerators.

TABLE 22

NUMBER OF HW INCINERATORS WITH STATED GAS RESIDENCE TIME

Residence Time (seconds)	Number of Incinerators
<1.0	14
1.0 - 1.49	20
1.5 - 1.99	20
≥2.0	50
Sample Size	104

TABLE 23

HW INCINERATOR TYPE vs GAS RESIDENCE TIME

Incinerator Type	Gas Residence Time (in Seconds) <1.0	1.0-1.49	1.5-1.99	≥2.0	Unknown
Liquid Injection	6	11	14	23	82
Hearth with Liquid Capability	1	4	5	4	19
Fume with Liquid Capability	6	2	—	4	12
Rotary Kiln with Liquid Capability	—	—	—	4	6
Combination System[(a)]	—	1	—	1	3
Rotary Kiln (solids only)	—	—	—	—	1
Hearth (solids only)	1	1	1	8	12
Ammunition and Explosives (military)	—	—	—	3	8
Ammunition and Explosives (non-military)	—	—	—	—	1
Drum Burner	—	1	—	—	6
Other (b)	—	—	—	3	10
Type Not Specified	—	—	—	—	20
Total	14	20	20	50	180

(a) Includes interconnected multiple units (e.g., hearth connected in series with liquid injection unit).

(b) Includes such items as fluidized-bed incinerators.

incinerators although temperature data were provided for 61 percent. This paucity of data was probably caused by two factors:

- The inability to directly measure residence time
- Lack of clear understanding of the definition of residence time

This latter cause was more evident among operators of small incinerators burning solids who misinterpreted residence time as the burnout time required to incinerate solids in the combustion chamber. The gaseous residence time is the time that a parcel of vapor moving through the system remains at the combustion temperature.

Almost half of the respondents reported gaseous residence times equal to or greater than two seconds. Incinerators burning solids have slightly greater residence times than those burning liquids but the data are too sparse to establish this correlation definitively.

Table 24 shows the combined temperature and residence time data for the different types of incinerators. The bottom row of data shows the distribution of temperature and residence times for all types of incinerators. Incinerators with high combustion zone temperatures tend to have long gaseous residence times. Of the 54 incinerators operating at combustion temperatures over 1900°F, 39 (74 percent) also had residence times of two seconds or more. In contrast, only 11 of 45 (24 percent) of the incinerators operating at combustion temperatures of 1900°F or below had residence times of two seconds or more.

TABLE 24

HW INCINERATOR TYPE VS. TEMPERATURE/RESIDENCE TIME

Temperature	1600°F			1601°F-1900°F			1901°F-2200°F			2200°F				
Residence Time (Secs.)	1.0	1.0 -1.9	2.0	1.0	1.0 -1.9	2.0	1.0	1.0 -1.9	2.0	1.0	1.0 -1.9	2.0	Unknown	Total
Incinerators Burning Liquids	7	8	4	1	17	3	0	4	22	4	4	6	123	203
Combination Systems(a)	0	0	0	0	0	0	0	1	0	0	0	1	3	5
Incinerators Burning Solids	0	0	2	1	0	0	0	0	6	0	1	0	14	24
Ammunition and Explosives	0	0	0	0	0	0	0	0	3	0	0	0	9	12
Drum Burners	0	0	0	0	0	0	0	1	0	0	0	0	6	7
Others(b)	0	0	2	0	0	0	0	0	1	0	0	0	10	13
Type Not Specified	0	0	0	0	0	0	0	0	0	0	0	0	20	20
Total	7	8	8	2	17	3	0	6	32	4	5	7	185	284

Note: For the 284 incinerators for which data were gathered, only 99 reported both combustion zone temperature and gas residence time.

(a) Includes interconnected multiple units (e.g., hearth connected in series with liquid injection unit).

(b) Includes such items as fluidized bed incinerators.

3.2.3 Waste Characteristics

Tables 25 through 35 present data on the characteristics of wastes being incinerated. Table 25 shows the number of HW incinerators reporting specific hazardous wastes and the annual quantity of waste incinerated. Tables 26 through 33 report the same data as a function of incinerator type and capacity. In all of the tables, the wastes are identified using EPA's hazardous waste codes, as presented in the Federal Register (45FR33119-33133, May 19, 1980 and subsequent amendments). The description corresponding to each code used in this report is given in Appendix D.

Where possible, non-listed ignitable wastes (D001) were divided into four categories based on the heat content and hazardous constituent concentration of the waste stream. A high heat content (high Btu) waste is one greater than 6000 Btu per pound. A highly hazardous waste (high HW) is one with hazardous constituent concentrations greater than 50 percent. The four categories used in the tables are:

- high Btu, high HW (such as spent organic liquids)
- low Btu, low HW (such as contaminated water)
- high Btu, low HW (such as trash, paper, rags, etc. contaminated with hazardous waste)
- waste light oils (lubricating and cutting oils with a flash point of 140°F or less)

No waste streams with low Btu and high HW were reported.

TABLE 25

NUMBER OF HW INCINERATORS REPORTING SPECIFIC HAZARDOUS WASTE AND QUANTITY BURNED

Waste Code[a]	Number of Incinerators		Quantity
	Reporting Waste	Reporting Quantity	Short Tons/Yr
D001 (High BTU, High HW)[b]	69	60	39,578
D001 (Low BTU, Low HW)	19	17	140,015
D001 (High BTU, Low HW)	6	3	5,870
D001 (Waste light oils)	3	2	1,610
D001 (Type unspecified)	7	5	21,190
D002, D003	32	30	191,895
All other D wastes	5	4	8,090
F001, F002	18	11	17,945
F003	22	18	233,120
F004	5	5	40
F005	24	21	18,253
F006	1	1	310
F017	4	3	40
Ammunition & Related Waste	8	2	8
Trash combined with small quantity of HW	6	5	4,900
K011	3	3	120,000
K016	1	1	4,400
K018, K019, K020, K030 mixed	4	4	15,000
K019	4	4	16,165
K020	1	1	2,600
K027	2	2	13,200
K048	2	0	--
K049	1	1	5,000
K051	1	1	500
K070	1	1	58
K083	5	5	3,113
P022	1	1	16
P063	6	5	135,325
P068	2	1	0.2
P080	1	0	--
P095	1	1	1,120
U003	2	2	2,905
U019	1	1	12
U023	1	1	40
U029	1	1	180
U037	2	2	0.1
U045	1	1	0.2
U098	1	0	--
U099	1	1	0.2

(a) See Appendix D for Descriptions of the waste streams corresponding to each waste code.

(b) High Btu = >6000 Btu per pound
High HW = major portion of waste is hazardous (e.g., organic liquids)
Low HW = major portion of waste is non-hazardous (e.g., contaminated water)

TABLE 25 (Concluded)

Waste Code	Number of Incinerators		Quantity Short Tons/Yr
	Reporting Waste	Reporting Quantity	
U122	1	1	85
U130	1	1	420
U133	1	0	--
U154	2	2	450
U159	1	1	10
U188	3	1	37
U220	3	3	10,801
U239	2	2	6

TABLE 26

NUMBER OF LIQUID INJECTION INCINERATORS WITH STATED CAPACITY AND HAZARDOUS WASTE

Type of Waste[a]	Capacity (Gallons per Hour) 0 - 50	51 - 100	101 - 200	201 - 300	301 - 500	501 - 1000	1001 - 2000	2001 - 5000	5001 - 10,000	Unknown
Unknown	5	2	5	4	3	8	1			8
D001 (High Btu, High HW)	9	1	8	7	3	2	1		3	4
D001 (Low Btu, Low HW)	4	1			1	2	2	1		
D001 (High Btu, Low HW)			1							
D001 (Waste light oils)		1	1				1			
D001 (Type unspecified)	1	1								
D002, D003	1	1	4	5		2	1	1	4	1
All other D waste	2									
F001, F002	5					3	1			
F003	8	1	1		1	2				
F004		1		3						
F005	7	1	1	1	1	2	1		3	
All other F waste	1									
Ammunition & Related Waste										
Trash plus some HW										
K011									3	
K016					1					
K018, K019, K020, K030 mixed		4								
K019			1			1				
K020						1				
K027										

(a) See Appendix D for descriptions of the waste streams corresponding to each waste code.

TABLE 26 (Concluded)

Type of Waste[a]	Capacity (Gallons per Hour)									
	0 - 50	51 - 100	101 - 200	201 - 300	301 - 500	501 - 1000	1001 - 2000	2001 - 5000	5001 - 10,000	Unknown
K048										
K049				1						
K051				1						
K070	1									
K083	2	2								
P022				1						
P063		2							3	1
P068	1				1					
P080				1						
P095										
U003		2								
U019										
U023				1						
U029										
U037										1
U045										
U098					1					
U099	1									
U122		1								
U130				1						
U133					1					
U154		1				1				
U159	1									
U188		1				1				
U220	1				1					
U239										
None (unit on standby)	2									

TABLE 27

NUMBER OF HEARTHS OR CHAMBERS (LIQUID) WITH STATED CAPACITY AND HAZARDOUS WASTE

Type of Waste[(a)]	Capacity (Gallons per Hour)									
	0 - 50	51 - 100	101 - 200	201 - 300	301 - 500	501 - 1000	1001 - 2000	2001 - 5000	5001 - 10,000	Unknown
Unknown	2	1	1	2			1	1		3
D001 (High Btu, High HW)	1	1	2	1			1			
D001 (Low Btu, Low HW)							1			
D001 (High Btu, Low HW)		2								
D001 (Waste light oils)										
D001 (Type unspecified)			1	1	1					
D002, D003	1							1		
All other D waste										
F001, F002	1		1							1
F003	1	2	1							2
F004										
F005		1					1			
All other F waste	1									
Ammunition & Related Waste										
Trash plus some HW										
K011										
K016										
K018, K019, K020, K030 mixed										
K019										
K020										
K027										1

(a) See Appendix D for descriptions of the waste streams corresponding to each waste code.

TABLE 27 (Concluded)

Type of Waste[(a)]	Capacity (Gallons per Hour)									
	0 - 50	51 - 100	101 - 200	201 - 300	301 - 500	501 - 1000	1001 - 2000	2001 - 5000	5001 - 10,000	Unknown
K048										
K049										
K051										
K070										
K083										
P022										
P063										
P068										
P080										
P095										
U003										
U019										
U023										
U029	1									
U037										
U045	1									
U098										
U099										
U122										
U130										
U133										
U154										
U159										
U188										
U220	1									
U239	1			1						
None (unit on standby)										

TABLE 28

NUMBER OF FUME/LIQUID INCINERATORS WITH STATED CAPACITY AND HAZARDOUS WASTE

Type of Waste[(a)]	Capacity (Gallons per Hour) 0 - 50	51 - 100	101 - 200	201 - 300	301 - 500	501 - 1000	1001 - 2000	2001 - 5000	5001 - 10,000	Unknown
Unknown	1									2
D001 (High Btu, High HW)		8				1				
D001 (Low Btu, Low HW)	2	2	1							2
D001 (High Btu, Low HW)										
D001 (Waste light oils)										
D001 (Type unspecified)							1			
D002, D003				1						
All other D waste										
F001, F002										
F003										
F004										
F005										
All other F waste										
Ammunition & Related Waste										
Trash plus some HW										
K011										
K016										
K018, K019, K020										
K030 mixed										
K019										
K020										
K027					1					

(a) See Appendix D for descriptions of the waste streams corresponding to each waste code.

TABLE 28 (Concluded)

Type of Waste [(a)]	Capacity (Gallons per Hour)									
	0 - 50	51 - 100	101 - 200	201 - 300	301 - 500	501 - 1000	1001 - 2000	2001 - 5000	5001 - 10,000	Unknown
K048										
K049										
K051										
K070										
K083										
P022										
P063										
P068										
P080										
P095				1						
U003										
U019				1						
U023										
U029										
U037										
U045										
U098										
U099										
U122										
U130										
U133										
U154										
U159										
U188										
U220										
U239										
None (unit on standby)										

TABLE 29

NUMBER OF ROTARY KILNS (REPORTING LIQUIDS ONLY) WITH STATED LIQUID CAPACITY AND HAZARDOUS WASTE

Type of Waste [a]	Capacity (Gallons per Hour) 0 - 50	51 - 100	101 - 200	201 - 300	301 - 500	501 - 1000	1001 - 2000	2001 - 5000	5001 - 10,000	Unknown
Unknown	1					1	2			1
D001 (High Btu, High HW)							3			
D001 (Low Btu, Low HW)										
D001 (High Btu, Low HW)										
D001 (Waste light oils)										
D001 (Type unspecified)										
D002, D003					1		2			
All other D waste										
F001, F002							3			
F003			1							
F004										
F005			1				1			
All other F waste										
Ammunition & Related Waste										
Trash plus some HW										
K011										
K016										
K018, K019, K020, K030 mixed										
K019										
K020										
K027										

(a) See Appendix D for descriptions of the waste streams corresponding to each waste code.

TABLE 29 (Concluded)

Type of Waste (a)	Capacity (Gallons per Hour)									
	0 - 50	51 - 100	101 - 200	201 - 300	301 - 500	501 - 1000	1001 - 2000	2001 - 5000	5001 - 10,000	Unknown
K048										
K049										
K051										
K070										
K083										
P022										
P063										
P068										
P080										
P095										
U003										
U019										
U023										
U029										
U037										
U045										
U098										
U099										
U122										
U130										
U133										
U154										
U159										
U188										
U220										
U239										
None (unit on standby)										

TABLE 30

NUMBER OF COMBINATION INCINERATORS WITH STATED LIQUID CAPACITY AND HAZARDOUS WASTE

Type of Waste [a]	Capacity (Gallons per Hour)									
	0 - 50	51 - 100	101 - 200	201 - 300	301 - 500	501 - 1000	1001 - 2000	2001 - 5000	5001 - 10,000	Unknown
Unknown							1	1		
D001 (High Btu, High HW)		1	1							
D001 (Low Btu, Low HW)										
D001 (High Btu, Low HW)										
D001 (Waste light oils)										
D001 (Type unspecified)										
D002, D003										
All other D waste										
F001, F002										
F003										
F004										
F005		1								
All other F waste										
Ammunition & Related Waste										
Trash plus some HW							1			
K011										
K016										
K018, K019, K020, K030 mixed										
K019										
K020										
K027										

[a] See Appendix D for descriptions of the waste streams corresponding to each waste code.

TABLE 30 (Concluded)

Type of Waste[(a)]	Capacity (Gallons per Hour) 0 - 50	51 - 100	101 - 200	201 - 300	301 - 500	501 - 1000	1001 - 2000	2001 - 5000	5001 - 10,000	Unknown
K048										
K049										
K051										
K070										
K083										
P022										
P063										
P068										
P080										
P095										
U003										
U019										
U023										
U029										
U037										
U045										
U098										
U099										
U122										
U130										
U133										
U154										
U159										
U188										
U220										
U239										
None (unit on standby)				1						

TABLE 31

NUMBER OF ROTARY KILNS (REPORTING SOLIDS ONLY) WITH STATED CAPACITY AND HAZARDOUS WASTE

Type of Waste[(a)]	Capacity (Pounds per Hour) 0 - 100	101 - 300	301 - 500	501 - 1000	1001 - 2000	2001 - 5000	5001 - 10,000	10,001 - 20,000	Unknown
Unknown									
D001 (High Btu, High HW)									
D001 (Low Btu, Low HW)									
D001 (High Btu, Low HW)									
D001 (Waste light oils)									
D001 (Type unspecified)									
D002, D003									
All other D wastes									
F001, F002	1								
F003									
F004									
F005									
All other F waste									
Ammunition & Related Waste									
Trash plus some HW									
K011									
K016									
K018, K019, K020, K030 mixed									
K019									
K020									
K027									

(a) See Appendix D for descriptions of the waste streams corresponding to each waste code.

TABLE 31 (Concluded)

Type of Waste (a)	Capacity (Pounds per Hour)								
	0 - 100	101 - 300	301 - 500	501 - 1000	1001 - 2000	2001 - 5000	5001 - 10,000	10,001 - 20,000	Unknown
K048									
K049									
K051									
K070									
K083									
P022									
P063									
P068									
P080									
P095									
U003									
U019									
U023									
U029									
U037									
U045									
U098									
U099									
U122									
U130									
U133									
U154									
U159									
U188									
U220									
U239									
None (unit on standby)									

TABLE 32

NUMBER OF HEARTH OR CHAMBER INCINERATORS (SOLIDS ONLY) WITH STATED CAPACITY AND HAZARDOUS WASTE

Type of Waste[(a)]	Capacity (Pounds per Hour)								
	0 - 100	101 - 300	301 - 500	501 - 1000	1001 - 2000	2001 - 5000	5001 - 10,000	10,001 - 20,000	Unknown
Unknown		1	3	1					2
D001 (High Btu, High HW)		1		1		2			1
D001 (low Btu, Low HW)									
D001 (High Btu, Low HW)	1	1				1			
D001 (Waste light oils)									
D001 (Type unspecified)			1						
D002, D003		1	1	1		2			
All other D wastes									
F001, F002									
F003						1			
F004						1			
F005						1			
All other F waste	1				1				
Ammunition & Related Waste									
Trash plus some HW					1				
K011									
K016									
K018, K019, K020, K030 mixed									
K019					1			1	
K020									
K027									

(a) See Appendix D for descriptions of the waste streams corresponding to each waste code.

TABLE 32 (Concluded)

Type of Waste [(a)]	Capacity (Pounds per Hour) 0 - 100	101 - 300	301 - 500	501 - 1000	1001 - 2000	2001 - 5000	5001 - 10,000	10,001 - 20,000	Unknown
K048									
K049									
K051									
K070									
K083									
P022									
P063									
P068									
P080									
P095									
U003									
U019									
U023									
U029									
U037									1
U045									
U098									
U099									
U122									
U130									
U133									
U154									
U159									
U188			1						
U220									
U239									
None (unit on standby)									

TABLE 33

NUMBER OF OTHER TYPES OF INCINERATORS WITH STATED CAPACITY AND HAZARDOUS WASTE

Type of Waste[a]	Capacity (Pounds per Hour) 0 - 100	101 - 300	301 - 500	501 - 1000	1001 - 2000	2001 - 5000	5001 - 10,000	10,001 - 20,000	Unknown
Unknown		1		2		1			10
D001 (High Btu, High HW)				2		1			1
D001 (Low Btu, Low HW)									
D001 (High Btu, Low HW)									
D001 (Waste light oils)									
D001 (Type unspecified)									
D002, D003			1	1					1
All other D wastes				2					
F001, F002				1					1
F003				1					
F004									
F005	1								
All other F waste	1								
Ammunition & Related Waste				1	1				6
Trash plus some HW						3			
K011									
K016									
K018, K019, K020, K030 mixed									
K019									
K020									
K027									

(a) See Appendix D for descriptions of the waste streams corresponding to each waste code.

TABLE 33 (Concluded)

Type of Waste[(a)]	Capacity (Pounds per Hour)								
	0 - 100	101 - 300	301 - 500	501 - 1000	1001 - 2000	2001 - 5000	5001 - 10,000	10,001 - 20,000	Unknown
K048									
K049									
K051									
K070									
K083				1					
P022									
P063									
P068									
P080									
P095									
U003									
U019									
U023									
U029									
U037									
U045									
U098									
U099									
U122									
U130									
U133									
U154									
U159									
U188									
U220									
U239									
None (unit on standby)									

The most frequently reported waste was the non-listed ignitable waste with high Btu and high HW content. Of 284 incinerators, 69 (24 percent) were reported burning this waste. Other commonly reported wastes were the corrosive (D002) and reactive (D003) wastes, by 11 percent of the incinerators, and two categories of spent non-halogentated solvents, F003 and F005, by 8 percent of the incinerators. Most facilities reported incineration of wastes with multiple waste codes.

The largest annual quantity of waste reported is the F003 waste (spent non-halogenatated solvents) with acetone and xylene being commonly reported as the principal constituents. Eighteen incinerators reported incinerating over 233,000 tons per year of this waste.

Except for these F003 wastes, all wastes reported in large quantities (greater than 100,000 tons per year) are aqueous. Incineration of 192,000 tons of aqueous corrosive and reactive wastes was reported by thirty incinerators. Other large quantities of aqueous wastes are reported in the categories of D001, low Btu/low HW ignitables; K011, wastewater from acrylonitrile production; and, P063, hydrocyanic acid. Most of these aqueous wastes are not suited for recycle or recovery and it is usually not cost-effective to ship such large quantities of waste off-site for disposal.

Table 34 shows the source of hazardous wastes burned in each EPA Region in terms of on-site or off-site generation of the waste. Of 177 respondents, 136 (77 percent) reported that all waste was generated on-site. Of the 32 facilities reporting incineration of wastes generated off-site, 28 (88 percent) are commercial incinerators.

Table 35 shows the source of individual waste types in terms of on-site or off-site generation of the waste. There does not appear to be any obvious pattern to this data, except that large quantities of aqueous wastes are rarely transported off-site for incineration.

One large chemical manufacturer with incinerators at several locations throughout the nation stated that all chlorinated wastes were shipped to one incinerator facility for destruction. Only non-chlorinated wastes were incinerated on-site.

3.2.4 Air Pollution Control and Heat Recovery Data

Table 36 shows the number of incinerators which were reported to use air pollution control devices (APCDs). Of the 223 units for which information was obtained, 101 (45 percent) were reported to use one or more APCD. Respondents representing 100 of these 101 units provided at least partial information about the types of APCD used. Most of the incineration systems (83 units, 37 percent of those for which data was obtained) used some form of scrubber system, often in combination with a quench, and/or other device.

TABLE 34

SOURCE OF HAZARDOUS WASTE BEING INCINERATED (BY FACILITY)

EPA Region	On-Site[(a)]	Off-Site[(b)]	Mixed[(c)]	Respondents Per Region
I	6	1	1	8
II	14	2	1	17
III	17	4	1	22
IV	24	9	4	37
V	16	6	1	23
VI	40	7	0	47
VII	5	1	0	6
VIII	4	0	1	5
IX	10	2	0	12
X	0	0	0	0
Respondents Per Category	136	32	9	177

(a) On-Site: All waste being incinerated is generated on the facility's site.

(b) Off-Site: All waste being incinerated is transported to the facility. These facilities are mostly commercial incinerators.

(c) Mixed: A portion of the waste being incinerated is transported to the facility. In such cases, the source of the waste is almost always another facility of the same company.

TABLE 35

TYPE OF HAZARDOUS WASTE vs SOURCE OF WASTE

(By Number of Facilities and Annual Quantity Burned)

Waste Type[a]	Waste Source Categories		
	On-Site	Off-Site	Mixed
D001 (High Btu, High HW)[b]	47(34,085)[c]	5(3,115)	3(2,168)
D001 (Low Btu, Low HW)	10(139,865)	--	1(150)
D001 (High Btu, Low HW)	5(5,870)	--	--
D001 (Waste light oils)	1(1,600)	1(10)	--
D001 (Type unspecified)	3(21,190)	--	--
D002, D003	16(184,335)	2(203)	1(11)
Other D	3(8,090)	--	--
F001, F002	7(7,064)	3(145)	5(10,723)
F003	16(230,120)	--	2(5,400)
F004	2(40)	--	--
F005	16(12,844)	--	1(5,400)
Other F	3(350)	1(0.2)	1(0.1)
Ammunition & Related Waste	4(8)	--	--
Trash with small amount of HW	3(5,900)	--	--
K011	1(120,000)	--	--
Other K	11(60,036)	--	--
P063	3(135,325)	--	--
Other P	5(1,136)	--	--
U220	2(10,801)	--	--
Other U	13(3,956)	1(13)	1(0.25)

(a) See Appendix D for descriptions of the waste streams corresponding to each waste code.

(b) High Btu: >6000 Btu per pound.
High HW: major portion of waste is hazardous (e.g. organic liquids).
Low HW: major portion of waste is non-hazardous (e.g. contaminated water).

(c) Number of facilities (estimated annual short tons).

TABLE 36

NUMBER OF HW INCINERATORS IN EACH EPA REGION REPORTING AIR POLLUTION CONTROL DEVICES

EPA Region	Have APCD	No APCD	Unknown	Total Per Region
I	2	8	2	12
II	11	10	7	28
III	12	11	7	30
IV	15	26	18	59
V	9	10	12	31
VI	42	43	10	95
VII	1	5	2	8
VIII	3	2	0	5
IX	6	7	3	16
X	0	0	0	0
Total	101	122	61	284

Table 37 presents data on the presence of APCD's on incinerators operating at various combustion temperatures and residence times. Of those incinerators with APCD's, 41 percent operate at temperatures over 2000°F and residence times of more than two seconds. Only 13 percent of the incinerators without APCDs operated at such high temperatures and long residence times. Examination of the table indicates that incinerators operating at high combustion zone temperatures are more likely to use APCDs than those operating at lower combustion zone temperatures: 78 percent of the incinerators operating above 2000°F used some form of APCD. Only 26 percent of the incinerators operating below 1800°F used an APCD.

Tables 38, 39, and 40 present data on the use of heat recovery devices with HW incinerators. Heat recovery was employed by 40 out of 178 respondents (22 percent). No geographical pattern was apparent in the use of heat recovery. Although not indicated by these tables, a major reason for not installing heat recovery equipment is that an intermittent operating schedule does not provide a continuous output of recovered energy. (Nearly 50 percent of the incinerators were reported to operate less than 30 percent of the time--Table 19).

The data in Tables 39 and 40 indicate that a relatively larger percentage of incinerators burning liquids (26 percent) employ heat recovery than incinerators burning solids (10 percent). In

TABLE 37

NUMBER OF HW INCINERATORS WITH STATED TEMPERATURE/RESIDENCE TIME REPORTING AIR POLLUTION CONTROL DEVICES

Temperature	Residence Time (seconds)	Number of Incinerators		
		with APCD	Without APCD	Unknown
≥2201°F	≥2	7	1	-
	1.0-1.9	4	1	-
	>1.0	4	-	-
2101 - 2200°F	≥2	7	-	3
	1.0-1.9	-	-	-
	>1.0	-	-	-
2001 - 2100°F	≥2	5	5	-
	1.0-1.9	1	1	-
	<1.0	-	-	-
1901 - 2000°F	≥2	5	5	1
	1.0-1.9	1	3	-
	<1.0	-	-	-
1801 - 1900°F	≥2	-	-	-
	1.0-1.9	2	3	-
	<1.0	-	-	-
1701 - 1800°F	≥2	2	1	-
	1.0-1.9	1	9	-
	<1.0	-	-	1
1601 - 1700°F	≥2	-	-	-
	1.0-1.9	-	2	-
	<1.0	1	-	-
1501 - 1600°F	≥2	-	1	-
	1.0-1.9	3	2	-
	<1.0	-	-	-
≤1500	≥2	1	6	-
	1.0-1.9	1	1	1
	<1.0	1	6	-
Total		46	47	6

TABLE 38

HAZARDOUS WASTE INCINERATION FACILITIES WITH HEAT RECOVERY

EPA Region	Facilities With Heat Recovery	Facilities Responding to Question (Sample Size)
I	2	7
II	3	17
III	2	20
IV	7	33
V	3	21
VI	14	56
VII	3	7
VIII	0	5
IX	6	12
X	0	0
Total	40	178

TABLE 39

CAPACITY AND TYPE OF HW INCINERATORS BURNING LIQUIDS AND REPORTING HEAT RECOVERY

Incinerator Type	Heat Recovery Unit	Capacity (Gallons Per Hour)										
		0-50	51-100	101-200	201-300	301-500	501-1000	1001-2000	2001-5000	5001-10000	Unknown	Total
Liquid Injection	Yes	5	3	3	4	2	11	3	0	1	1	33
	No	28	10	9	11	5	9	2	1	3	11	89
	Not Known	4	0	3	1	2	0	1	1	0	2	14
Hearth or Chamber/ Liquid	Yes	1	0	1	1	1	0	0	0	0	1	5
	No	4	5	4	1	0	0	3	2	0	6	25
	Not Known	1	0	0	2	0	0	0	0	0	0	3
Fume/ Liquid	Yes	2	1	1	1	0	0	0	0	0	2	7
	No	1	9	0	1	1	1	2	0	0	2	17
	Not Known	0	0	0	0	0	0	0	0	0	0	0
Rotary/ Liquid	Yes	0	0	1	0	0	0	2	0	0	0	3
	No	1	0	0	0	1	1	3	0	0	1	7
	Not Known	0	0	0	0	0	0	0	0	0	0	0
Combination System	Yes	1	0	0	0	0	0	0	0	0	0	1
	No	0	0	0	0	0	1	0	0	0	2	3
	Not Known	0	0	0	0	0	0	1	0	0	0	1
Total	Yes	9	4	6	6	3	11	5	0	1	4	49
	No	34	24	13	13	7	12	10	3	3	22	141
	Not Known	5	0	3	3	2	0	2	1	0	2	18

TABLE 40

CAPACITY AND TYPE OF HW INCINERATORS BURNING SOLIDS AND REPORTING HEAT RECOVERY

Incinerator Type	Heat Recovery Unit	Capacity (Pounds Per Hour)									
		0-100	101-300	301-500	501-1000	1001-2000	2001-5000	5001-10000	10001 - 20000	Unknown	Total
Rotary Kiln, Solids Only	Yes	0	0	0	0	0	0	0	0	0	0
	No	1	0	0	0	0	0	0	0	0	1
	Not Known	0	0	0	0	0	0	0	0	0	0
Hearth or Chamber, Solids	Yes	0	1	0	1	1	1	0	0	0	4
	No	2	3	5	2	2	1	0	1	1	17
	Not Known	0	0	0	0	0	0	0	0	2	2
Other Types, Solids	Yes	0	0	0	1	0	0	0	0	0	1
	No	0	1	2	7	0	5	1	0	10	26
	Not Known	1	0	0	0	1	0	0	0	3	5
Total	Yes	0	1	0	2	1	1	0	0	0	5
	No	3	4	7	9	2	6	1	1	11	44
	Not Known	1	0	0	0	1	0	0	0	5	7

addition, larger liquid injection units are more likely to have heat recovery than smaller units. This correlation may exist because smaller solids burning and liquid units generally do not produce a sufficiently uniform energy supply to warrant heat recovery. However, the data are too sparse to confirm this correlation.

3.2.5 Hazardous Waste Destruction in Other Thermal Devices

Tables 41, 42, and 43 present data on the number of facilities burning hazardous waste in boilers or process kilns for energy recovery. Thirty-two facilities reported burning hazardous waste in boilers and five facilities reported burning hazardous waste in process kilns. It is not possible to make any valid estimate to the extent of this practice from these data, because facilities burning HW in boilers and process kilns were not required to file Part A applications. The facilities listed in Table 41 had an erroneous indication of HW incinerator in the HWDMS.

Table 42 shows the types and quantities of wastes reported to be burned in boilers for energy recovery. Of 32 facilities, 13 (41 percent) reported the burning of high Btu, high HW content ignitable waste (D001). Most of the other facilities reported burning various spent solvents. Toluene (U220) was specifically mentioned by representatives of two facilities. Table 43 shows the types and quantities of wastes reported to be burned in process kilns for energy recovery. Most of the wastes burned are high Btu content

TABLE 41

NUMBER OF FACILITIES IN EACH EPA REGION BURNING HAZARDOUS WASTE IN BOILERS OR PROCESS KILNS

Region	Boilers	Kilns
I	7	0
II	2	3
III	5	2
IV	6	0
V	6	0
VI	2	0
VII	1	0
VIII	1	0
IX	2	0
X	0	0
Total	32	5

TABLE 42

NUMBER OF FACILITIES REPORTING TYPE AND ANNUAL QUANTITY OF HAZARDOUS WASTE BURNED IN BOILERS

Waste[b]	Number of Boilers[a] Reporting Waste	Number of Boilers[a] Reporting Quantity	Quantity (Short tons/year)
D001 (High Btu, High HW)	13	7	45,446
D001 (Low Btu, Low HW)	1	0	—
D002/003	1	0	—
Other D	2	2	80
F001, F002	2	2	1
F003	4	3	2,306
F004	4	4	1,273
U220	2	2	51,261
Other U	3	2	365
Unknown	5	0	—

(a) Total number of boilers reporting hazardous waste burned = 32

(b) See Appendix D for descriptions of the waste streams corresponding to each waste code

TABLE 43

NUMBER OF FACILITIES REPORTING TYPE AND ANNUAL QUANTITY OF HAZARDOUS WASTE BURNED IN PROCESS KILNS

Waste [b]	Number of Kilns [a]		Quantity (Short tons/year)
	Reporting Waste	Reporting Quantity	
F001, F002	4	1	9,980
F003	1	1	4,990
F005	1	1	4,990
U002	1	1	1,435
U159	1	1	1.435
U220	1	1	1,600
U239	1	1	320

(a) Total number of boilers reporting hazardous waste burned = 32

(b) See Appendix D for descriptions of the waste streams corresponding to each waste code halogenated and non-halogenated spent solvents. Specific chemicals reported include acetone, methyl ethyl ketone, toluene, and xylene.

Three other facilities reported burning hazardous wastes in devices which they or the EPA Regional Office consider not to be incinerators. In one case, a chemical manufacturer burns waste in a thermal treatment unit of a process stream. A second company uses petroleum still bottoms as fuel in a spent petroleum catalyst roaster. The third facility thermally oxidizes hydrochloric acid and chlorinated hydrocarbons for reuse.

APPENDIX A

NAMES, ADDRESSES, PHONE NUMBERS AND CONTACTS FOR HAZARDOUS WASTE INCINERATOR VENDORS

APPENDIX A

Air Resources
600 N. First Bank Dr.
Palatine, IL 60067
(312) 359-7810 - Edward Dowd

Basic Environmental Engineering Inc.
21 W. 161 Hill Avenue
Glen Ellyn, IL 60137
(312) 469-5340 - Raymond Familiar

Baumco Inc.
2970 U.S. Steel Bldg.
Pittsburg, PA 15219
(412) 261-3555 - Mukash Patal

Bayco Industries of California
2108 Davis Street
San Leandro, CA 94577
(415) 562-6700 - Kent Whelan

Bigelow-Liptak Corp.
21201 Civic Center Drive
Southfield, MI 48076
(313) 353-5400 - David McCormick

Brule C.E.&E., Inc.
13920 Southwestern Avenue
Blue Island, IL 60406
(312) 388-7900 - Peter Sharpe

Burn-Zol Corp.
P.O. Box 109
Dover, NJ 07801
(201) 361-5900 - Steve Parker

C&H Combustion
1985 W. Big Beaver Rd.
Troy, MI 48084
(313) 649-3850 - Michael Gerlach

APPENDIX A (Continued)

C.E. Raymond Co.
Bartlett Snow Division
Combustion Engineering Inc.
200 W. Monroe St.
Chicago, IL 60606
(312) 236-4044 - William Rohn

CEA Combustion Inc.
61 Taylor Reed Pl.
Stamford, CT 06906
(203) 359-1320 - Millard E. Prowler

CICO Inc.
1600 W. Haskell
Appleton, WI 54911
(414) 734-9861

Coen Company
Burlingame, CA
(415) 697-0440 - Al Davis

Commercial Fabrication & Machine Co., Inc.
P.O. Box 472
Mount Airy, NC 27030
(919) 786-8374 - Roddy Street

Copeland Associates, Inc.
125 Windsor Dr.
Oak Brook, IL 60521
(312) 986-8564 - Arthur Simmers

Dorr Oliver, Inc.
77 Havemeyer Lane
Stamford, CT 06904
(203) 358-3676 - Peter Angevine

Dravo Engineers and Constructors
One Oliver Plaza
Pittsburgh, PA 15222
(412) 566-3490 - Jean-luc Glorieux

APPENDIX A (Continued)

Ecologenics Corp.
P.O. Box 348
Red Lion, PA 17356
(717) 244-8549 - Jackie Smith

Econo-Therm Energy Systems Corp.
11535 K-Tel Drive
Minnetonka, MN 55343
(612) 938-3100 - Bob Smith

Enercon Systems, Inc.
16115 Puritas Avenue
Cleveland, OH 44135
(216) 267-0555 - John S. Somodi

Energy Inc.
P.O. Box 736
Idaho Falls, ID 83401
(208) 529-1000 - Robert R. Newell

Entech Industrial Systems, Inc.
The Woodlands, TX 77380
(713) 353-2319 - Aziz Jamaluddin

Environmental Control Products, Inc.
11100 Nations Ford Rd.
P.O. Box 15753
Charlotte, N.C. 28210
(704) 588-1620 - Bud Strope

Environmental Elements Corp.
(Sub. of Koppers Co., Inc.)
P.O. Box 1318
Baltimore, MD 21203
(301) 796-7334 - Wm. G. Leedy, Jr.

Fuller Co.
Bethlehem, PA
(215) 264-6011 - Richard Shafer

HPD, Inc.
1717 N. Naper Blvd.
Naperville, IL 60540
(312) 357-7330 - Tim Rittof

APPENDIX A (Continued)

Hirt Combustion Engineers
931 South Maple Ave.
Montebello, CA 90640
(213) 728-9164 - John Hirt

Howe-Baker Engineers, Inc.
P.O. Box 956
Tyler, TX 75710
(214) 597-0311 - George Lomax

Industronics, Inc.
489 Sullivan Ave.
P.O. Drawer G.
S. Windsor, CT 06074
(203) 289-1588 - Allan E. Caffyn

International Incinerators, Inc.
P.O. Box 19
Columbus, GA 31902
(404) 327-5475 - John H. Robertson

John Zink Co.
4401 S. Peoria Ave.
Tulsa, OK
(918) 747-1371 - Duane Schaub (X454)

Kelley Co., Inc.
6720 N. Teutonia Avenue
Milwaukee, WI 53207
(414) 352-1000 - Jim Kidd

Lurgi Corp.
One Davis Drive
Belmont, CA 94002
(415) 592-4060 - Terry Allan

McGill, Inc.
P.O. Box 9667
Tulsa, OK 74107
(919) 445-2431 - Ron Bell

APPENDIX A (Continued)

Met-Pro Corp., Sys. Div.
160 Cassell Rd.
P.O. Box 144
Harleysville, PA 19438
(215) 723-6751 - Carl Janson

Midland-Ross Corp.
2275 Dorr Street
Toledo, OH 43691
(419) 537-6176 - Irwin Williams

Morse Boulger, Inc.
53-09 97th Pl.
Corona, NY 11368 - Bob LaBua

Niro Atomizer, Inc.
9165 Rumsey Rd.
Columbia, MD 21045
(301) 997-8700 - Pierre Biedermann

P&T Manufacturing Co.
P.O. Box 451
Tualatin, OR 97062
(503) 638-9602 - Gray Thorn

Peabody International Corp.
4 Landmark Sq.
Stamford, CT 06901
(203) 348-0000 - Steve Korn

Perstorp, Inc.
238 Nonotuck St.
Florence, MA 01060
(413) 584-2472 - Ulf Ljung

Plibrico
1800 N. Kingsbury Ave.
Chicago, IL 60614
(312) 549-7014 - J.B. Cowrshon

Prenco, Inc.
29800 Stephenson Hwy.
Madison Heights, MI 48071
(313) 399-6262 - Lee McNew

APPENDIX A (Continued)

Pyro Magnetics Corp.
200 Essex Street
P.O. Box 288
Whitman, MA 02382
(617) 447-0448 - Dennis Dyer

Rockwell International
8900 DeSoto Ave.
Canoga Park, CA 91304
(213) 341-1000 - Al Stewart

Shirco, Inc.
2451 Stemmons Hwy.
Dallas, TX 75207
(214) 630-7511 - Mike Hill

Sunbeam Equipment Corp.
Comtro Division
180 Mercer Street
Meadville, PA 16335
(814) 724-1456 - Edward Donley

Sur-Lite Corp.
8130 Allport Ave.
Santa Fe Springs, CA 90670
(213) 693-0796 - William Davis

TR Systems Inc.
701 John Fitch Blvd.
S. Windsor, CT 06033
(203) 528-3728 - James Monroe

Tailor & Co., Inc.
P.O. Box 587
Davenport, IA 52805
(319) 355-2621 - John Tailor

Thermal Processes, Inc.
507 Willow Springs Road
La Grange, IL 60525
(312) 747-6600 - John Ruhl

APPENDIX A (Concluded)

ThermAll, Inc.
P.O. Box 1776
Peapack, NJ 07977
(201) 234-1776 - David F. Norris

Trane Thermal Co.
Brook Rd.
Conshohocken, PA 19428
(215) 828-5400 (X45) - Robert Branch

Trofe Inc.
Pike Road
Mt. Laurel, NJ 08054
(609) 235-2036 - Henry J. Stein

United Corporation
1947 N. Topeka Blvd.
Topeka, KS 66608
(913) 232-2349 - Kelly Pettit

U.S. Smelting Furnace Co.
C.E. Industries Corp.
P.O. Box 446
Belleville, IL 62222
(618) 233-0129 - Tom Leveling

Vulcan Iron Works, Inc.
United Penn Bank Bldg., Room 1050
Wilkes Barre, PA 18701
(717) 822-2161 - Maurice Shafer

Washburn & Granger, Inc.
85 5th Avenue
P.O. Box 304
Patterson, NJ 07524
(211) 278-1965 - Mr. Stelling

APPENDIX B

LIST OF POSSIBLE HAZARDOUS WASTE INCINERATION FACILITIES

Table B-1 presents the list of 612 facilities which were identified as possible operators of one or more operational hazardous waste incinerators. Of these, 566 were identified from HWDMS as of 30 November 1981. The remaining 46 were identified either from the literature or personal knowledge of MITRE staff. This list does not and is not meant to indicate all possible HW incinerator facilities in the U.S. Furthermore, inclusion on the list does not necessarily mean the facility operates a HW incinerator.

The contact status column indicates those facilities successfully contacted (indicated by X) during either the work prior to this project or the current effort. Thirteen contacts were never completed due to an inability to reach a company spokesman (indicated by A). Contact was not attempted with 35 facilities (indicated by a blank). Most of these were facilities for which Part A data were not available from HWDMS. Thus there were no data to verify.

The incinerator status column gives a capsule summary of whether or not the facility had an operational hazardous waste incinerator (indicated by Y or N). The other codes indicate various other situations existing at the facility. A complete explanation of the codes is given at the end of the table.

The other information sources column indicates those sources (other than telephone contact) which produced data or information about the facility. An explanation of the source codes is given at the end of the table.

Table B-2 lists the name and locations of the 84 facilities shown on the HWDMS retrieval for 12 July 1982 which did not appear on the HWDMS retrieval for 30 November 1981. The seven facilities whose names are preceded by an asterisk were listed in Table B-1 as of 30 November as possible incinerators, but were not listed in HWDMS at that time. They have since been listed in HWDMS.

TABLE B-1

CONTACT STATUS AND INCINERATOR STATUS OF FACILITIES IDENTIFIED AS POSSIBLY HAVING A HAZARDOUS WASTE INCINERATOR

REGION I

State	Company	Location	Incinerator Verification Contact	Incinerator Verification Status	Other Information Sources(1)
CT	American Cyanimid Co.	Wallingford	X	B	
CT	Belding Chemical Industries	Grosvenor	X	Y-1	
CT	Bic Pen Corporation	Milford	X	Y-1	
CT	Bridgeport Harbor Station	Bridgeport	X	B	
CT	Combustion Engineering	Windsor	X	Y-1	
CT	Dow Chemical Co. (Allyn's Pt.)	Ledyard	X	C	
CT	Ensign-Bickford Co.	Simsbury	X	N	
CT	Handy & Harman Fairfield Plant	Fairfield	X	N	
CT	Homer Bronson Company	Beacon Falls	A		
CT	M. Swift and Sons Inc.	Canton	X	F	
CT	Marlin Firearms Co.	North Haven	X	N	
CT	New Haven Harbor Station	New Haven	X	B	
CT	*Pfizer, Inc.	Groton	X	U	
CT	Pratt and Whitney	East Hartford	X	Y-1	
CT	Raybestos Manhatten Co.	Stratford	X	B	
CT	Risdan Corp.	Danbury	A		
CT	Rogers Corp-Molding Mat Div.	Manchester	X	F	
CT	Royal Business Machines, Inc.	West Hartford	X	F	
CT	UNC Naval Products	Uncasville	X	?	
CT	Water Pollution Control Plant	West Haven	X	Y-2	B
CT	Yankee Metal Products Corp.	Norwalk	X	N	
ME	*Maine Oil Recycling	Buckfield			
ME	Millington Enterprises	Lincolnville	A		
ME	Union Chemical Co., Inc.	South Hope	X	Y-1	A,C
ME	d-USAF Loring AFB	Limestone	X	B	
MA	Acushnet Company	New Bedford	X	N	
MA	American Optical	Southbridge	X	N	
MA	Auto Circuit Inc.	Lowell	X	N	

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*Facility had not appeared in HWDMS as of the 30 November 1981 retrieval date.

d-Facility delisted as hazardous waste incinerator as of 12 July 1982.

(1) See end of table for codes.

REGION I (concluded)

State	Company	Location	Incinerator Verification Contact	Incinerator Verification Status	Other Information Sources(1)
MA	Borden Chemical Co.	Leominster	X	F	
MA	Cannons Engineering Corp.	Bridgewater	X	C	
MA	Compugraphic Corp.	North Reading	A		
MA	Conductorlab Inc.	Groton	X	N	
MA	Glines and Rhodes Inc.	Attleboro	X	N	
MA	GTR Manufacturing Corp.	Brockton	X	N	
MA	ICI Americas	Dighton	X	Y-1	
MA	Millipore Corp.	Bedford	X	B	
MA	N. American Phillips Lighting	Lynn	X	N	
MA	*Northeast Solvents Rec.	N. Andover			
MA	Polaroid Corp.	Waltham	X	Y-2	
MA	Recycling Industries, Inc.	Braintree	X	N	
MA	Spalding, Div. of Questor	Chicopee	X	B	
MA	Stackpole Fibers Co., Inc.	Lowell	X	F	
MA	Trombetta Inc.	Marlboro	X	Y-1	
MA	USM Machinery Division	Beverly	X	N	
NH	Chemical Consolidated Inc.	Nashua	X	N	
NH	Coating Systems, Inc.	Nashua	X	N	
NH	Merrimack Station - Pub. Svc.	Bow	X	N	
NH	Nashua Corp.	Merrimack	X	N	
NH	Newington Station - Pub. Svc.	Newington	X	N	
NH	Schiller Station	Portsmouth	X	N	
RI	Amtrol Inc.	West Warwick	X	Y-1	
RI	Gannon and Scott, Inc.	Cranston	X	U	
RI	d-Providence Metalizing Co.	Pawtucket	X	U	
RI	RMI Refinery Inc.	Mapleville	X	N	
VT	*Resource Conser. & Rec.	Brattleboro			

REGION II

State	Company	Location	Incinerator Verification Contact	Incinerator Verification Status	Other Information Sources(1)
NJ	*All County Env. Service	Glenwood			
NJ	American Cyanamid Co.	Linden	X	C	
NJ	*Applied Technology	Toms River			
NJ	Arsynco Inc.	Carlstadt	X	B	
NJ	*Carter-Wallace	Cranberry	X	N	
NJ	David Sarnoff, RCA Corp.	West Windsor	X	N	
NJ	E.I. DuPont	Deepwater	X	Y-4	
NJ	Engelhard Industries Div.	Carteret	X	Y-1	
NJ	Engelhard Minerals & Chemical	East Newark	X	Y-1	
NJ	Essex Chemical Corp.	Sayreville	X	N	
NJ	FMC Corp.	Plainsboro	X	Y-1	
NJ	Gateway Terminal Service	Carteret	X	U	
NJ	d-Hoffman-LaRoche	Nutley	X	N	
NJ	Industrial Silver Co.	Old Bridge	X	N	
NJ	Intl. Flavors & Fragrances	Union Beach	X	L	
NJ	Matheson Div., Searle Medical	East Rutherford	X	N	
NJ	Merck & Co.	Rahway	X	N	
NJ	Metz Metallurgical Corp.	So. Plainfield	X	N	
NJ	Millmaster Chemical Co.	Berkeley Heights	X	N	
NJ	Modern Transportation Co.	S. Kearny	X	N	
NJ	Ortho Diagnostic Systems	Raritan	X	N	
NJ	Ortho Pharmaceutical Corp.	Raritan	X	B	
NJ	Pantasote Inc.	Passaic	X	F	
NJ	Penick Corp.	Lyndhurst	X	F	
NJ	Penick Corp.	Newark	X	F	
NJ	Pharmaceuticals Civ. Ciba-Geigy	Summit	X	N	
NJ	Reichhold Chemicals	Carteret	X	C	
NJ	Reichhold Chemicals	Elizabeth	X	U	
NJ	*Rollins	Bridgeport	X	Y-1	
NJ	Rutgers University	Piscataway	X	N	
NJ	d-Sandoz	Hanover	X	N	
NJ	*SCA Chemical Services	Newark	X	U	
NJ	d-Schering-Plough	Union	X	N	
NJ	d-Squibb Co.	New Brunswick	X	N	
NJ	Union Carbide Corp.	Keasbey	X	F	
NJ	Union Carbide Corp.	Piscataway	X	Y-1	
NJ	Vanguard Research Assoc.	So. Plainfield	X	N	
NJ	*Warner-Lambert	Morris Plains	X	N	
NY	Active Steel Drum Inc.	Long Island	X	Y-1	
NY	Alpha Portland Cement	Cementon	X	K	
NY	Anitec Image Corp.	Binghamton	X	F	

REGION II (continued)

State	Company	Location	Incinerator Verification		Other Information Sources(1)
			Contact	Status	
NY	Battery Disposal Technology	Clarence	X	Y-1	
NY	Bell Test Center AF Plant	Buffalo	X	Y-1	B
NY	Bendix Corp.	Sidney	X	Y-1	
NY	Brookhaven Nat. Lab	Upton	X	N	
NY	*Bristol Myers	Syracuse	X	N	
NY	Burroughs Corp.	Rochester	X	F	
NY	Case Hoyt Corporation	Rochester	X	Y-1	
NY	Food & Drug Research Labs.	Waverly	X	Y-1	
NY	Frontenac Environmental Svc.	Niagara Falls	X	N	
NY	G.E. Insulating Materials	Schenectady	X	F	
NY	*General Electric Co.	Waterford			
NY	Goodyear Tire & Rubber	Niagara Falls	X	F	
NY	*Haz-O-Waste	Wampsville			
NY	Hooker Chemicals & Plastics	N. Tonawanda	X	Y-1	
NY	Hooker Chemicals & Plastics	Niagara Falls	X	Y-1	
NY	Ingersoll-Rand Co.	Painted Post	X	N	
NY	IBM Corp.	Endicott	X	F	
NY	Kay-Fries Inc.	Stony Point	X	C	
NY	Kodak Park Div., Eastman Kodak	Rochester	X	Y-1	D
NY	*Lederle Labs, American Cyanamid	Pearl River	X	N	
NY	Nepera Chemical Co.	Harriman	X	Y-2	
NY	Norlite Corp.	Cohoes	X	K	
NY	Northeast Solite Corp	Mt. Marion	X	K	
NY	Philips ECG Inc. (GTE Products)	Seneca Falls	X	Y-1	
NY	Reichhold Chemical Co.	Niagara Falls	X	Y-1	
NY	Residual Fuel Storage Tank	Jamesville	X	N	
NY	Roth Bros. Smelting Corp.	E. Syracuse	X	?	
NY	Specialty Metals Div/Crucible	Syracuse	X	N	
NY	Techtronics Solvents Recovery	Brooklyn	X	N	
NY	Tri Cities Barrel Co.	Port Crane	A		
NY	University of Rochester	Rochester	X	N	
NY	*West Central Environmental	Auburn			
PR	Bristol Labs	Mayaguez	X	N	
PR	Cyanamid Agricultural	Manati			
PR	Eli Lilly and Co.	Mayaguez	X	Y-1	
PR	Merck	Barceloneta	X	Y-1	
PR	Pfizer	Barceloneta	X	U	
PR	Rico Chemical Corp.	Guayanilla			
PR	Schering Corp.	Manati	X	N	
PR	Searle and Co.	Caguas			
PR	Smith Kline	Guayama	X	Y-3	

REGION II (concluded)

State	Company	Location	Incinerator Verification		Other Information Sources(1)
			Contact	Status	
PR	Squibb	Hamacao	X	Y-1	
PR	Syntex (F.P.) Inc.	Humacao			
PR	Winthrop Labs	Barceloneta			
VI	VI Water & Power Authority	St. Thomas			
VI	VI Water & Power Authority	St. Croix			

REGION III

State	Company	Location	Incinerator Verification Contact	Incinerator Verification Status	Other Information Sources(1)
DE	Hercules Res. Center	Wilmington	X	Y-1	
DE	d-Diamond Shamrock Plastics	Delaware City	X	N	
DE	DuPont Exp. Station	Wilmington	X	Y-1	
DC	PEPCO-Benning Road St.	Washington	X	N	
DC	PEPCO-Buzzard Point St.	Washington	X	N	
DC	Solid Waste Reduction Center	Washington	X	N	
MD	*American Recovery Co.	Baltimore			
MD	Andrews AFB	Camp Springs	X	N	
MD	Central Chemical Corp.	Elkton	X	Y-1	
MD	Energy Optimization Inc.	Baltimore	X	U	
MD	FMC Corp., Ag. Chem. Group	Baltimore	X	Y-2	
MD	GMC-GMAD	Baltimore	X	N	B
MD	Litton Bionetics	Rockville	X	Y-1	
MD	Multichem	Baltimore	X	Y-2	A
MD	PEPCO-Chalk Point St.	Aquasco	X	N	
MD	PEPCO-Dickerson St.	Dickerson	X	N	
MD	PEPCO-Morgantown St.	Newburg	X	N	
MD	Thiokol Corp., Elkton Div.	Elkton	X	C	
PA	Arco Chemical Res. & Engr. Ctr.	Newtown Square	X	N	
PA	d-Atlas Powder Co.	Reynolds	X	N	
PA	Avtex Fibers Inc.	Meadville	X	U	
PA	Babcock & Wilcox, Koppel	Koppel	X	N	
PA	d-Beck Engraving	Philadelphia	X	N	
PA	d-Bethlehem Steel	Williamsport	X	N	
PA	d-Bowen-McLaughlin-York Co.	York	X	N	
PA	Delaware Container Co.	Coatsville	X	N	
PA	Ecology Chemical & Refining	Manor	X	N	
PA	General Electric	Erie	X	Y-1	
PA	Indl. Solvents & Chemicals	York Haven	X	Y-1	
PA	Knoll International Inc.	E. Greenville	X	Y-1	
PA	Koppers Co., Inc.	Bridgeville	X	Y-1	
PA	Letterkenny Army Depot	Chambersburgh	X	Y-1	
PA	Merck & Company	Riverside	X	N	
PA	Merck & Company	West Point	X	N	
PA	Met-Pro Corp., Systems Div.	Harleysville	X	N	
PA	Metal Bank of America	Philadelphia	X	N	
PA	National Rolling Mills	Malvern	X	N	
PA	PPG	Springdale	X	B	
PA	d-Park Container	Easton	A		
PA	d-PENELEC-Homer City Gen. Sta.	Center Twp.	X	N	

REGION III (concluded)

State	Company	Location	Incinerator Verification Contact	Incinerator Verification Status	Other Information Sources(1)
PA	d-PENELEC-Keystone Gen. Sta.	Armstrong Twp.	X	N	
PA	d-PENELEC-Seward Gen. Sta.	E. Wheatfield	X	N	
PA	d-PENELEC-Warren Gen. Sta.	Conewango Twp.	X	N	
PA	d-ENELEC-Williamsburg Gen. Sta.	Woodbury Twp.	X	N	
PA	d-PENELEC-Conemaugh Gen. Sta.	W. Wheatfield	X	N	
PA	d-PENELEC-Front Street Gen. Sta.	Erie	X	N	
PA	d-PENELEC-Shawville Gen. Sta.	Bradford Twp.	X	N	
PA	Pennwalt	King of Prussia	X	L	
PA	Philips ECG, Inc.	Emporium	X	B	
PA	Pittsburgh Pacific Processing	Pittsburgh	X	Y-1	
PA	d-Rohm and Haas	Spring House	X	N	
PA	Smith Kline Chem-Riverside	Conshohocken	X	U	
PA	Superior Tube Co.	Collegeville	X	B	
PA	Trane Thermal Co.	Conshohocken	X	Y-2	D,E
PA	U.S. Steel Corp. Chem. Div.	Neville Is.	X	L	
PA	University of Pittsburgh	Pittsburgh	X	Y-1	
PA	*Wyeth Labs	Paoli	X	U	
PA	Zapata Industries, Inc.	Frackville	X	Y-1	
VA	Allied Chemical Corp.	Hopewell	X	E	
VA	Atlantic Wood Industries Inc.	Portsmouth	X	B	
VA	Freeman Chem. Corp.	Chatham	X	N	
VA	Merck & Company	Elkton	X	N	
VA	Naval Weapois Station	Yorktown	X	L	
VA	PEPCO-Potomac River Sta.	Alexandria	X	N	
VA	Philip Morris Mfr. Center	Richmond	X	N	
VA	Solite Corp.	Cascade	X	K	
VA	Solite Corp.	Arvonia	X	K	
VA	Thomasville Furniture Ind.	Appomattox	X	Y-1	
VA	Univ. of Virginia	Charlottesville	X	Y-1	
WV	American Cyanamid Co.	Willow Island	X	Y-2	
WV	Borg-Warner Chem-Weston Pl. #1	Morgantown	X	Y-2	
WV	Dupont E.I. deNemours	Belle	X	B	
WV	Dupont E.I. deNemours	Parkersburg	X	Y-1	
WV	FMC Corp. Specialty Chem. Div.	S. Charleston	X	C	
WV	Mobay Chem. Corp.	New Martinsville	X	Y-3	
WV	Monsanto	Nitro	X	Y-1	
WV	Pantasote Inc.	Pt. Pleasant	X	F	
WV	Union Carbide Corp.-Tech. Ctr.	S. Charleston	X	Y-1	
WV	Union Carbide Corp-Bulk Ter.	S. Charleston	X	F	
WV	Union Carbide Corp.-PTO Ter.	Nitro	X	F	
WV	Union Carbide-Plant 514	S. Charleston	X	U	

REGION IV

State	Company	Location	Incinerator Verification		Other Information Sources(1)
			Contact	Status	
AL	Alabama Wood Treating	Mobile	X	N	
AL	Anniston Army Depot	Bynum	X	Y-1	
AL	Beech Aircraft	Selma	X	N	
AL	Birmingham News	Birmingham	X	N	
AL	d-Chem Haulers	Wylam	X	N	
AL	Chemical Waste Management	Emelle	X	Y-1	
AL	Ciba-Geigy	McIntosh	X	Y-1	B
AL	Kay-Fries Alabama Inc.	Theodore	X	Y-1	
AL	*M&M Chemical & Equip.	Gasden	X	N	
AL	Monsanto Co.	Anniston	X	F	
AL	Redstone Arsenal	Redstone Arsenal	A		
AL	Shell Chem Co.-Mobile Plant	Axis	X	Y-1	
AL	Southern Research Institute	Birmingham	X	N	
AL	Stauffer	Bucks	X	Y-5	
AL	Uniroyal	Opelika	X	B	
AL	3M	Decatur	X	Y-1	
FL	Alpha Chemical Corp.	Lakeland	X	Y-1	
FL	Homestead AFB	Homestead AFB	X	Y-1	
FL	Honeywell	St. Petersburg	X	Y-1	
FL	JFK Space Center	JFK Space Center	X	Y-1	B
FL	Olin Corp.	St. Marks	X	Y-1	
FL	d-Orlando Utility	Titusville	X	N	
FL	P.M. Craftsman	Eaton Park	X	N	
FL	South Dade Incinerator	Miami	X	U	B
FL	Treesweet Products	Ft. Pierce	X	N	
FL	United Technologies	W. Palm Beach	X	Y-1	
FL	University of Florida	Gainesville	X	N	
FL	U.S. DOE-Pinellas Plant	Largo	X	Y-1	
FL	d-U.S. Diversified Inc.	Knoxville	A		
GA	B&M Wood Products	Manor	X	N	
GA	Bernath Barrel	Mableton	X	Y-1	A
GA	Cargill	Forest Park	X	Y-1	A
GA	Emory University	Atlanta	X	N	
GA	General Electric Co.	Rome	X	N	
GA	Goodyear	Rockmart	X	N	
GA	J&B Smith Co., Inc.	Atlanta	X	Y-1	
GA	Meredith, William C. Co.	East Point	X	B	
GA	Southeastern Waste Treatment	Dalton	X	Y-1	A
GA	Tri-State Steel Drum Co.	Graysville	X	Y-1	
GA	Union Carbide-Ag Products	Woodbine	X	Y,U-1	
GA	University of Georgia	Athens	X	N	

REGION IV (continued)

State	Company	Location	Incinerator Verification Contact	Incinerator Verification Status	Other Information Sources(1)
KY	Air Products	Calvert City	X	L	
KY	B-T Energy Group	Louisville	X	N	
KY	Central Fill Inc.	Louisville	X	N	
KY	Didier Taylor Refractories Corp.	South Shore	X	N	
KY	DuPont	Louisville	X	Y-1	
KY	GAF Corp.	Calvert City	X	N	
KY	Heublein Inc.	Paducah	X	Y-1	
KY	LG&S Disposal Co.	Louisville	X	U	
KY	Lexington-Depot Activity	Lexington	X	N	
KY	*Liquid Waste Disposal	Calvert City	X	Y-3	
KY	Olin	Brandenburg	X	Y-1	
KY	Wiedemann (George) Brewing Co.	Newport	X	N	
MS	Enterprise Recovery System	Cayce	X	N	
MS	First Chemical	Pascagoula	X	Y-1	
MS	d-Miss. State Univ. Landfill	Starkville	X	N	
MS	Reichhold Chemicals, Inc.	Gulfport	X	B,C	
NC	AMF Hatteras Yacht	New Bern	X	N	
NC	AMF Hatteras Yacht	High Point	X	N	
NC	Broyhill Furniture	Lenoir	X	Y-1	
NC	Burroughs Wellcome	Greenville	X	Y-1	B
NC	Caldwell Systems	Lenoir	X	Y-1	A
NC	Carolina Power & Light	New Hill	X	N	
NC	Charlotte Steel Drum	Charlotte	X	Y-1	
NC	*Chem. Ind. Inst. Toxicology	R.T.P.	X	Y-1	A
NC	Concord Rocky River Reg. WWTP	Concord	X	N	
NC	Diamond Shamrock Corp.	Castle Hayne	X	N	
NC	Duke University	Durham	X	N	
NC	DuPont	Phoenix	X	Y-2	
NC	GE	Wilmington	X	N	
NC	Lithium Corp.	Bessemer City	X	Y-2	
NC	Martin Marietta Corp.	Charlotte	X	N	
NC	Mitchell Systems	Spruce Pine	X	Y,U-1	
NC	Proctor Chemical	Salisbury	X	N	
NC	SCA Chem. Services Inc.	Charlotte	X	U	
NC	Singer Furniture	Lenoir	X	Y-1	
NC	Textron Inc. Homelite Div.	Gastonia	X	N	
NC	Thomasville Furniture	Lenoir	X	N	
NC	Winston Container Co.	Charlotte	X	N	
NC	Zapata Industries, Inc.	Butner	X	Y-1	C

REGION IV (concluded)

State	Company	Location	Incinerator Verification		Other Information Sources(1)
			Contact	Status	
SC	ABCO Industries, Inc.	Roebuck	X	Y-2	
SC	American Enka	Central	X	Y-1	
SC	Badische Corp.	Anderson	X	N	
SC	Balchem Corp.	Green Pond	X	B	
SC	DuPont	Lugoff	X	Y-1	
SC	Ga. Pacific Furniture	Sumter	X	N	
SC	Greenwood Mills Liner Plant	Orangeburg	X	B	
SC	Hoechst Fiber	Spartanburg	X	C	
SC	Industrial Chemical	Rock Hill	A		
SC	Korn Industries	Sumter	X	B	
SC	MEPCO/Electra	Columbia	X	N	
SC	Owens Corning	Anderson	X	Y-1	
SC	Quality Drum	Rock Hill	A		
TN	Alpha Resins	Collierville	X	Y-1	A
TN	DuPont	Memphis	X	Y-3	
TN	Eastman Kodak	Kingsport	X	Y-3	
TN	Holston Army Ammo Plant	Kingsport	X	N	
TN	Huyck Formex	Greenville	X	Y-1	
TN	*Mobil Chem. Co.	Mt. Pleasant	A		
TN	Mt. Pleasant Chemical	Mt. Pleasant	X	L	
TN	*Oil Service Co.	Columbia	X	N	
TN	*Resource Recycling Tech.	Mt. Pleasant	X	Y-1	
TN	Rhone Poulenc Inc.	Mt. Pleasant	X	C	
TN	SCA Chem. Services Inc.	Memphis	X	U	
TN	*Solid & Liquid Waste Disposal	Dyersburg	X	Y-1	A,F
TN	Trane Co., Inc.	Clarksville	X	N	
TN	Union Carbide	Columbia	X	Y-1	
TN	Velsicol	Memphis	X	C	
TN	Volunteer Army Ammo Plant	Chattanooga	X	N	

REGION V

State	Company	Location	Incinerator Verification		Other Information Sources(1)
			Contact	Status	
IL	Abbott Laboratories	N. Chicago	X	N	
IL	Armak	Morris	X	Y-1	
IL	Cargill Inc.	Carpentersville	X	B	
IL	*Fred Rykowski & Sons	S. Beloit			
IL	FMC Chemical Group	Wyoming	X	N	
IL	Gardner Denver Co.	Quincy	X	N	
IL	Joliet Army Ammo Plant	Joliet	X	L	
IL	Koppers Company, Inc.	Chicago	X	Y-1	
IL	Ludlow Corp.	Chicago	X	L	
IL	Marathon-Robinson Refining	Robinson	X	Y-1	
IL	Meyer Steel Drum, Inc.	Chicago	X	Y-1	
IL	Monsanto Co., Krummrich Plant	Sauget	X	U	
IL	Morton Chem.	Ringwood	X	F	
IL	Natl. Starch & Chem. Corp.	Meredosia	X	B	
IL	Northern Petrochemical Co.	Morris	X	C	
IL	Paxton Landfill Corp.	Chicago	X	N	
IL	Pierce Chem. Co.	Rockford	X	N	
IL	Reilly Tar & Chem. Corp.	Granite City	X	Y-1	
IL	*SCA Chemical Services	Chicago	X	U	
IL	Spaulding Fiber Co. Inc.	Dekalb	X	Y-1	
IL	Texaco USA (Refining)	Lockport	X	Y-1	
IL	*Trade Waste Inc.	Sauget	X	Y-1	A
IL	Travenol Laboratories Inc.	Morton Grove	X	L	
IL	U.S. Army Savanna Army Depot	Savanna	X	N	
IL	3M-Cordova	Cordova	X	Y-1	
IN	Colgate-Palmolive Co.	Jeffersonville	X	N	
IN	*Enviro-Chem. Corp.	Zionsville			
IN	d-GMC-Delco, Kokomo Plant 5	Kokomo	X	N	
IN	GMC Allison Div. Plant 3	Indianapolis	X	N	
IN	GMC Allison Div. Plant 5	Indianapolis	X	Y-1	
IN	d-Gripco Fastener	Montpelier	X	N	
IN	*ILWD	Indianapolis			
IN	Lilly (Eli) & Co. Labs	Lafayette	X	Y-2	
IN	Lilly (Eli) & Co., Clinton Labs	Clinton	X	Y-1	B
IN	Miles Laboratories Inc.	Elkhart	X	B	
IN	Owens-Corning Fiberglass	Valparaiso	X	Y-1	
IN	*Prenco - City of South Bend	S. Bend	X	C	
IN	*Seymour Recycling	Seymour			
IN	Union Carbide	East Chicago	X	Y-1	
MI	A-1 Disposal Corp.	Plainwell	X	Y-1	A
MI	*Dow Chemical	Midland			

REGION V (continued)

State	Company	Location	Incinerator Verification Contact	Incinerator Verification Status	Other Information Sources(1)
MI	*Drug & Laboratory Disposal	Plainwell	X	N	
MI	*Egeler Industrial Waste	Traverse City			
MI	*Environmental Waste Control	Inkster			
MI	Essex Chemical	Hillsdale	X	N	
MI	FBC Chemical Inc.	Muskegon	X	U	
MI	d-GMC-Cadillac (Clark)	Detroit	X	N	
MI	GR Manufacturing	Grand Rapids	X	N	
MI	*Liquid Disposal	Utica			
MI	Reichhold Chemicals Inc.	Ferndale	X	B	
MI	Steelcase Inc.	Grand Rapids	X	B	
MI	Upjohn	Kalamazoo	X	Y-1	A
MN	Gopher Smelting	Eagan	X	N	
MN	Mayo Foundation	Rochester	X	Y-1	
MN	Whittaker Corp.	Minneapolis	X	C	
MN	3M - Chemolite	Cottage Grove	X	Y-1	
OH	d-Basic Inc.	Bettsville	X	N	
OH	Battelle Memorial Inst.	Columbus	X	N	
OH	Burton Rubber Processing Inc.	Burton	X	N	
OH	Case Western Reserve Univ.	Cleveland	X	N	
OH	*Cincinnati Ind. Waste Disp.	Cincinnati	X	Y-1	A,C,D
OH	Columbus Products Co.	Columbus	X	N	
OH	Dart Industries Inc.	Elyria	X	Y-1	
OH	d-Diamond Shamrock Res. Cntr.	Concord Twp.	X	N	
OH	d-Ebco Manufacturing Co.	Columbus	X	N	
OH	d-Formica Corp.	Cincinnati	X	N	
OH	d-GE Company Coshocton Plant	Coshocton	X	N	
OH	General Tire and Rubber Co.	Ashtabula	X	F	
OH	GTE Products Corp.	Ottawa	X	Y-1	
OH	Kittinger Trucking & Supply	Akron	X	N	
OH	PPG Industries	Delaware	X	C	
OH	Pristine Inc.	Reading	A		
OH	Ravenna Army Ammo Plant	Ravenna	X	N	
OH	Robert Ross and Sons, Inc.	Grafton	X	Y-1	A
OH	SCM Corp.	Huron	X	Y-1	
OH	TRW, Inc.	Cleveland	X	N	
OH	U.S. Industrial Chemicals	Cincinnati	X	Y-1	
OH	*Waste Technologies Industries	Liverpool			
OH	Whirlpool Corp.	Marion	X	N	

REGION V (concluded)

State	Company	Location	Incinerator Verification Contact	Incinerator Verification Status	Other Information Sources(1)
WI	Badger Army Ammo Plant	Baraboo	X	N	
WI	Briggs & Stratton Corp.	Menomonee Falls	X	B	
WI	Curwood Inc.	New London	X	Y-1	
WI	Freeman Chemical Corp.	Saukville	X	Y-2	
WI	Hydrite Chemical Co.	Milwaukee	X	N	
WI	Johnson, SC & Son, Inc.	Sturtevant	X	Y-1	
WI	Raltech Scientific Services	Madison	X	N	
WI	Trane Co. - Main Complex	La Crosse	X	Y-1	
WI	U. of Wisc., Arlington Farm	Arlington	X	Y-1	
WI	University of Wisconsin	Madison	X	N	
WI	*Waste Research & Reclamation	Eau Claire			

REGION VI

State	Company	Location	Incinerator Verification Contact	Incinerator Verification Status	Other Information Sources(1)
AR	Arkansas Eastman Co.	Batesville	X	Y-2	
AR	Diamond Shamrock	Van Buren	X	L	
AR	d-Dow	Russellville	X	N	
AR	*ENSCO	El Dorado	X	Y-1	C
AR	Maybelline	N. Little Rock	X	Y-1	
AR	Natl. Ctr-Toxicological Res.	Jefferson	X	Y-3	
AR	U.S. Electric Motors	Mena	X	N	
AR	U.S. Pine Bluff Arsenal	Pine Bluff	X	Y,U-3	
AR	Vought Chemical Corp.	East Camden	X	N	
AR	d-WW Technologists	Eldora	A		
AR	Westinghouse Electric Corp.	Little Rock	X	Y-1	
AR	Whirlpool	Fort Smith	X	N	
LA	Air Products	St. Gabriel	X	F	
LA	American Cyanamid Co.	Westwego	X	Y-2	
LA	BASF	Geismar	X	L	
LA	Borden Chemical	Geismar	X	Y-1	
LA	Chevron	Belle Chasse	X	Y-3	
LA	Ciba-Geigy	St. Gabriel	X	Y-1	
LA	Copolymer Rubber & Chemical	Baton Rouge	X	Y-1	
LA	*Dow	Plaquemine	X	Y-1	
LA	Dresser P&M	Eunice	X	Y-1	
LA	DuPont	La Place	X	L	
LA	Evans Cooperage	Harvey	X	Y-1	
LA	FMC-Agricultural Chem	Opelousas	X	C	
LA	Georgia-Pacific	Plaquemine	X	Y-1	
LA	d-Gould	Shreveport	X	L	
LA	Grant Chemical-Ferro Corp.	Zachary	X	Y-2	
LA	Gulf Refining-Grand Bay	Venice	X	N	
LA	Gulf Refining-West Bay	Venice	X	N	
LA	Gulf Refining-Ostrica	Beoras	X	N	
LA	Hercules, Inc.	Lake Charles	X	Y-1	
LA	Hooker Chem. (formerly Firestone Plastics)	Addis	X	U	
LA	LA Army Ammunition Plant	Shreveport	X	Y-1	
LA	Morton Chemical	Weeks Island	X	Y-1	F
LA	Olin	Lake Charles	X	Y-1	
LA	PPG	Westlake	X	Y-4	F
LA	Rollins	Baton Rouge	X	Y-1	
LA	Rubicon	Geismar	X	Y-1	B,F
LA	Shell Chemical	Norco	X	Y-3	F
LA	Stauffer Chemical	St. Gabriel	X	Y-2	

REGION VI (continued)

State	Company	Location	Incinerator Verification Contact	Incinerator Verification Status	Other Information Sources(1)
LA	Union Carbide	Taft	X	Y-4	F
LA	Union Tank Car Co.	Baton Rouge	X	N	
LA	Vulcan Materials Co.	Geismar	X	Y-1	C
NM	d-Univ. of New Mexico	Albuquerque	X	Y-1	
OK	Conoco	Ponca City	X	F	
OK	Eagle Pitcher/Boron Dept.	Quapaw	X	Y-1	B
OK	John Zink Co.	Tulsa	X	Y-1	A,E
OK	Phillips Research Center	Bartlesville	X	U	
OK	Zapata Industries, Inc.	Muskogee	X	Y-1	A,E
TX	Air Products	La Porte			
TX	Aztec/Purechem-Dart	Pasadena	X	Y-1	
TX	Badische	Freeport	X	Y-1	F
TX	Celanese Chemical Co.	La Porte	X	L	
TX	Celanese Chemical Co.	Corpus Christi	X	L	
TX	Celanese Chemical Co.	Pampa	X	L	
TX	Celanese Chemical Co.	Bishop	X	L	
TX	Celanese Chemical Co.	Pasadena	X	B	
TX	Celanese Plastics	Bishop	X	L	
TX	d-Diamond Shamrock/Independence	La Porte	X	Y-1	C
TX	d-Dow Chemical/Texas Div.	Freeport	X	Y-1	C
TX	*Dow Chemical/Oyster Creek Div.	Freeport	X	Y-1	C,F
TX	Dresser P&M	Dallas	X	Y-1	
TX	DuPont	La Porte	X	Y-4	F
TX	DuPont	Beaumont	X	Y-3	
TX	DuPont	Victoria	X	Y-3	
TX	Ethyl Corp.	Pasadena	X	E	
TX	El Paso Products	Odessa	X	Y-1	
TX	FMC	Pasadena	X	Y-1	
TX	General Dynamics	Fort Worth	X	N	
TX	General Tire & Rubber Co.	Odessa	X	Y-1	
TX	Goodyear Tire & Rubber	Beaumont	X	Y-1	
TX	Goodyear Tire & Rubber	Houston	X	Y-1	
TX	Gulf Chem & Met Div.	Freeport	X	E	
TX	Gulf Coast Waste Mgt.	Houston	X	N	
TX	IBM	Austin	X	Y-1	
TX	Mobay	Baytown	X	Y-1	
TX	Monsanto	Texas City	X	L	
TX	Monsanto	Alvin	X	L	
TX	NASA, Johnson Space Center	Houston	X	Y-1	

REGION VI (concluded)

State	Company	Location	Incinerator Verification		Other Information Sources(1)
			Contact	Status	
TX	d-Ortho Diagnostics	Arlington	X	C	
TX	PPG	Beaumont	X	Y-1	
TX	Pennwalt	Houston	X	L	
TX	Pennwalt	Beaumont	X	L	
TX	Peterbilt Motors Co.	Denton	X	U	
TX	Petro-Tex	Houston	X	N	
TX	Phillips	Pasadena	X	Y-1	
TX	Reichhold	Houston	X	L	
TX	Rohm & Haas	Deer Park			
TX	Rollins	Deer Park	X	Y-2	C,F
TX	Shell	Deer Park	X	Y-3	F
TX	Sheridan Disposal Service, Inc.	Hempstead	X	Y-1	
TX	Shintech	Freeport	X	F	
TX	Stauffer	Houston	X	N	
TX	Stauffer	Baytown	X	Y-1	
TX	Strawn Explosives	Bridgeport	X	N	
TX	Strawn Explosives	New Braunfels	X	N	
TX	Strawn Explosives	Strawn	X	N	
TX	Strawn Explosives	Ft. Stockton	X	N	
TX	Texaco Chemical Co.	Conroe	X	Y-1	
TX	Texaco Chemical Co.	Port Neches	X	Y-1	
TX	Texas A&M	College Station	X	Y-1	
TX	Texas Electric	Fort Worth	X	N	
TX	Texas Tech University	Lubbock	X	N	
TX	Union Carbide	Brownsville	X	B,C	
TX	U.S. Industrial Chemicals	La Porte	X	Y-1	
TX	U.S. Army Longhorn	Karmack	X	N	
TX	Univ. of Texas	Galveston	X	Y-1	
TX	Upjohn Polymer	La Porte	X	Y-1	F
TX	Vistron	Green Lake	X	Y-1	
TX	Vought	Dallas	X	Y-1	

REGION VII

State	Company	Location	Incinerator Verification		Other Information Sources(1)
			Contact	Status	
LA	Chemplex	Clinton	X	C	
LA	Firestone Tire	Des Moines	X	B	
LA	FMC Corp. Agricultural Chem.	Sergeant Bluff			
LA	Iowa Army Ammunition Plant	Middletown	X	U	
LA	John Deere	Waterloo	X	Y-1	
LA	Maytag	Newton	X	Y-1	
LA	Monsanto	Muscatine			
LA	Univ. of Iowa	Oakdale	X	Y-1	
KS	Abbott	Wichita	X	U	
KS	Pester	El Dorado	X	F	
KS	Pyrodex Production Plant	Herington	X	N	
KS	Sunflower Army Ammo Plant	DeSoto	X	U	
KS	Univ. of Kansas	Kansas City	X	N	
KS	Vulcan	Wichita	X	Y-1	
MO	Alcolac Inc.	Sedalia	X	C	
MO	American Cyanamid	Palmyra	X	Y-1	
MO	Farmland Industries	St. Joseph	X	N	
MO	Loxcreen	Hayti	X	N	
MO	d-Mallinckrodt	St. Louis	X	N	
MO	Mobay	Kansas City			
MO	Monsanto	St. Louis			
MO	Resource Recovery Ctr (U. of Mo.	Columbia	X	Y-1	
MO	Schuylkill Metals Corp.	Forest City	X	N	
MO	3M	Nevada	X	L	
NE	Cominco	Beatrice	X	N	
NE	Goodyear	Lincoln	X	Y-1	
NE	Willis Pyrolizer	Willis	X	Y-1	

REGION VIII

State	Company	Location	Incinerator Verification		Other Information Sources(1)
			Contact	Status	
CO	Arapahoe Chemicals	Boulder	X	Y-1	
CO	Boulder Scientific Co.	Mead	X	N	
CO	Colorado State U.-Coll. Ave.	Ft. Collins	X	N	
CO	Colorado State U.-Overland	Ft. Collins	X	Y-1	
CO	Martin Marietta	Waterton	X	B	
CO	Pueblo Depot Activity	Pueblo	X	N	
CO	Rio Blanco Oil Shale	Rifle	X	F	
CO	Rocky Mountain Arsenal	Commerce City	X	Y-1	
CO	Shell (RMA)	Commerce City	X	Y-1	
CO	*U.S. DOE Rocky Flats	Golden			
MT	Montana Power-Colstrip	Colstrip	X	N	
MT	Montana Power-Frank Bird	Billings	X	N	
MT	Montana Power-Corette	Billings	X	N	
MT	Union Tank Car Co.	Laurel	X	C	
ND	Amoco Oil	Mandan	X	L	
ND	Great Plains Gasification	Beulah	X	U	
UT	*Tooele Army Depot	Tooele	X	Y-1	
WY	FMC Corp. Phosphorous Chem.	Kemmerer	X	?	

REGION IX

State	Company	Location	Incinerator Verification		Other Information Sources(1)
			Contact	Status	
AZ	Navajo Depot Activity	Flagstaff	X	N	
AZ	Rogers	Chandler	X	F	
AZ	Unidynamics/Phoenix Inc.	White Tanks Mountain Area	X	L	
AZ	University of Arizona	Tucson	X	Y-1	
CA	Acrian	Cupertino	X	N	
CA	Aerojet General-Sacramento Rancho	Cordova	X	Y-1	
CA	Alpha Resins	Perris	X	Y-1	
CA	Ashland	Los Angeles	X	Y-1	
CA	Cargill	Lynwood	X	Y-1	
CA	Chevron Chemical Co.	Richmond	X	Y-1	
CA	Cook Paint & Varnish	Milpitas	X	Y-1	
CA	Defense Depot Tracy	Tracy	X	L	
CA	Dow	Pittsburg	X	N	
CA	Duolite	Redwood City	X	E	
CA	E.I. DuPont	S. San Francisco	X	F	
CA	Edwards Air Force Base	Edwards	X	U	
CA	Englehard Ind. West	Anaheim	X	U	
CA	IT Corp.-Vine Hill Facility	Martinez	X	N	
CA	Koppers	Oxnard	X	Y-1	
CA	Lawrence Livermore	Livermore	X	U	
CA	Lockheed Missiles & Space	Sunnyvale	X	Y-1	
CA	Louisiana Pacific	Antioch	X	N	
CA	Magna Corp.	Bakersfield	X	B	
CA	d-McClellan Air Force Base	Sacramento	X	Y-1	
CA	Physics International Co.	Tracy	X	N	
CA	PPG	Torrance	X	N	
CA	Shell	Martinez	X	Y-1	
CA	Stauffer Chem. Co.	Carson	X	Y-2	
CA	Teledyne McCormick Selph	Hollister	X	B	
CA	*Thermal Technology	Menlo Park		C	
HI	U.S. Naval Magazine Lualualei	Westloch	X	Y-1	
HI	Navy Public Works Center	Pearl Harbor	X	C	
HI	Unitek Environmental Ser.	Ewa Beach	X	Y-1	
NV	Hawthorne Army Ammunition Plt.	Hawthorne	X	Y-2	

REGION X

State	Company	Location	Incinerator Verification		Other Information Sources(1)
			Contact	Status	
WA	*Navy Submarine Base	Bremerton			

Key to Letter Codes:

1. Contact:
   X = Contact Made
   A = Attempted contact--company would not return calls or could not be reached

2. Status of Reported HW Incinerator(s):

   Y = Number of operational hazardous waste incinerator(s) at facility
   E = Operational hazardous waste incinerator, but operator claims exempt from RCRA
   N = No operational hazardous waste incinerator, boiler, kiln, or exempt device burning HW
   F = Fume incinerator only
   K = Process kiln only, burning HW
   B = Hazardous waste to boiler for heat recovery
   U = HW incinerator is
   - o under construction
   - o built but not operating yet
   - o in preconstruction permit stage

   C = HW incinerator is shut down (other than for maintenance or operational schedule)
   - o permanently
   - o but could be reactivated in future
   - o because entire facility is closed

   L = No information given without letter and/or corporate approval
   ? = Status unknown

3. Other Information Sources:

   A = Site visit made to facility
   B = Information obtained by letter from facility
   C = Trial burn (for Federal or State regulatory compliance); test burn (for other purposes than trial burn); or trial burn plan.
   D = Specific facility information from literature
   E = Specific facility information obtained from incinerator manufacturer's literature
   F = Stack test of emissions without analysis of waste feed

TABLE B-2

NEW ENTRIES TO HWDMS (30 November 1981 to 12 July 1982) IDENTIFIED AS POSSIBLY HAVING A HAZARDOUS WASTE INCINERATOR

State	Company	Location
	Region I	
CT	Caisser, E.J., Inc.	Stanford
CT	United Waste Oil Co.	Meriden
MA	Keating, P.J. Co.	Lunenburg
MA	South Essex Sewerage District	Salem
RI	Conservation Technologies	Bristol
	Region II	
NJ	American Cyanamid Co.	Bridgewater
NJ	Exxon Biomedical Sciences, Inc.	East Millstone
NJ	Polyrez Co., Inc.	Woodbury
NJ	U.S. Steel - Polyester Unit	Linden
PR	Environmental Management Services	Lajas
PR	Janssen Inc.	Gurabo
	Region III	
MD	Aberdeen Proving Ground	Aberdeen Proving Ground
MD	*American Recovery Co., Inc.	Baltimore
PA	Pennsylvania Engineering Corp.	Farrell
PA	Westinghouse Electric Corp.	Manor
VA	Radford Army Ammo Plant	Radford
WV	Union Carbide Corp.	Sisterville
	Region IV	
AL	University of South Alabama	Mobile
FL	Daniel Construction Co.	Johnson City
KY	Allied Drum Service Inc.	Louisville
KY	Dow Corning Corp.	Carrollton
KY	International Harvester Foundry	Louisville
NC	Army Reserve XVIII Airborne Corps	Fort Bragg

*Facility not in HWDMS as of 30 November 1981, but included in Table A-1 because other factors indicated possible existence of operational HWI. (Note: Some of these facilities have been contacted. See Table A-1 for status.)

TABLE B-2 (Continued)

Region V

State	Company	Location
IL	Alburn, Inc.	Chicago
IL	Borden, Inc.	Illiopolis
IL	Claire Manufacturing Co., Inc.	Addison
IL	Dick, AB, Co.	Chicago
IL	Kelley Springfield Tire Co.	Freeport
IL	Monsanto Co., WG Krummrich	Sauget
IL	Olin Corp., Tech Systems Operations	Marion
IL	Olin Corp., Main Plant	East Alton
IL	Powell Metals & Chemicals, Inc.	Rockford
IL	Rexnord Co., Rockford Products Corp.	Rockford
IL	*SCA Chemical Services	Chicag
IL	Sherwin-Williams Co.	Chicago
IL	Simmons Refining Co.	Chicago
IL	*Trade Waste Incineration, Inc.	Sauget
IN	Amoco Whiting Refinery	Whiting
IN	Energy Cooperative, Inc.	East Chicago
IN	Purdue University	West Lafayette
IN	U.S. Army, Newport Army Ammo Plant	Newport
IN	U.S. Navy, Naval Weapons Support Center	Crane
MI	Aero-Motive Manufacturing Co.	Kalamazoo
MI	American Cyanamid Co.	Kalamazoo
MI	BASF Wyandotte Corp	Wyandotte
MI	Besser Co.	Alpena
MI	*Dow Chemical Co.	Midland
MI	Liquid Disposal Inc.	Utica
MI	Michigan State University	East Lansing
MI	Midland Dow-Well Site	Midland
MI	Thermo Chem , Inc.	Muskegon
MI	Koch Refining Co.	Rosemount
MI	Midwest Asphalt Corp.	Eden Prairie
MI	Pollution Controls Inc.	Shakopee
MN	Union Scrap Iron & Metal Co.	Minneapolis
OH	CE Process Equipment Development Lab	Springfield
OH	*Cincinnati MSD L/F Incinerator	Cincinnati
OH	DAB Industries	Bellefontaine
OH	Diamond Shamrock Plastics Corp.	Concord Township
OH	Gulf Oil Co. Chemicals	Marietta
OH	Medical College of Ohio	Toledo

TABLE B-2 (Concluded)

Region V

State	Company	Location
OH	Midland Ross Thermal Systems Tech Center	Toledo
OH	PPG Industries Inc.	Circleville
OH	Rockwell International	Kenton
OH	Standard Oil Co. Ohio	Cleveland
OH	Union Carbide Corp.	Marietta
OH	Visitron Corp.	Lima
OH	*Waste Technologies Industries	Liverpool
OH	Kitzinger Cooperage Corp.	Milwaukee

Region VI

State	Company	Location
AR	Diaz Refinery Co.	Diaz
AR	*ENSCO (Energy Systems Co.)	El Dorado
AR	Prairie Grove Schools	Kenner
LA	Monsanto Company	Luling
LA	W&W Technologists	Slidell
TX	Atchison Topeka and Santa Fe RR	Somerville
TX	Dowell Div. of Dow Chemical USA	Graham
TX	El Paso Products Co., Odessa Facilities	Odessa
TX	Freeman Resins	Marshall
TX	Shirco, Inc.	Dallas
TX	University of Texas at Austin	Austin
TX	Whitco Chemical Corp.	Marshall

Region X

State	Company	Location
ID	Energy Inc.	Idaho Falls
OR	Teledyne Wah Chang	Albany
WA	Washington State University	Pullman

APPENDIX C

HWDMS DATA RETRIEVAL AND VERIFICATION

Version 3 of HWDMS, which was operational at the time of this study, could store up to 79 items of data for each facility which stores, treats or disposes of hazardous waste. A subset of these 79 items, which would provide the basic information about each HW incineration facility, was selected for retrieval. The data gathering and verification efforts of the project would add to this information to build as complete a data set as possible for each facility. Figure 1 (in the main body of the report) shows the printout for a typical retrieval of incineration related data from HWDMS for one of the 566 facilities which indicated incineration as one of its processes. Table C-1 lists the data content of a complete retrieval of such data. A complete data set was not available for all facilities. A retrieval of this type of data was made for each of the 566 facilities which indicated incineration in their process codes.

Figure C-2 shows the telephone log sheet used for verification of data retrieved from HWDMS. In addition to HW incinerator data, the forms also contained some basic verification questions pertaining to HW storage in containers, tanks and surface impoundments. These data were verified in order to avoid repetitive contact with the same facility by OSW. These data were provided to OSW separately.

TABLE C-1

DATA CONTENT OF THE RETRIEVALS MADE FROM HWDMS FOR EACH HW INCINERATION FACILITY

Data Code	Explanation (if necessary)
FAC-ID	Official EPA identification number of facility
FAC-NAME	Name of facility
FAC-STRT FAC-CITY FAC-ZIP	Geographical location of facility
MAIL-STRT MAIL-CITY MAIL-ZIP	Mailing address of facility
CONTACT	Name and title of facility spokesman
PHONE-NO	Telephone number of spokesman
GENERATR	X indicates facility generates HW
TSDF-IND	X indicates facility treats, stores and/or disposes of HW
OWN-NAME	Legal owner of facility
LATITUDE LNGITUDE	Geographical coordinates
EXIS-DTE	Date facility began operation (not necessarily the same as the start of any HW incinerator)
PER-TYPE PER-NUM	Type and number of any existing environmental permits
SIC-CODE SIC-DSCR	Principal activity or activities at the facility

TABLE C-1
(concluded)

Data Code	Explanation (if necessary)
WASTE-CD WST-DSCR WASTE-AM W-PROCES	A listing of all HW incinerated and/or stored at the facility including the quantity handled in metric tons per year and whether the waste is incinerated and/or stored in containers, tanks, waste piles and/or surface impoundments.
C-PROCES C-AMOUNT C-UNIT	A listing of all HW treatment, storage and disposal processes "to be used at the facility" including the total capacity of each process

REGION:________

Date(s) of contact(s) or attempts:________________________________

Facility ID#: ______________

Caller: ______________

LOG SHEET FOR PART A CONFIRMATIONS

1. **Background:**

*Facility name: ________________________________

*Facility address: ________________________________

*Facility coordinates: Latitude ________ Longitude ________

*Facility SIC code: ________________________________

Contacts:

Facility contacts ________________________________

Technical contacts ________________________________

2. **Processes:**

*Does facility have an operational hazardous waste incinerator? Yes____ No____

If so, what type ________________________________

If not, is an incinerator planned? Yes____ No____

If not, why is incineration shown on permit application? ________________________________

*Capacity of incinerator? ________________________________

*Age of incinerator? ________________________________

*Does facility have containers? Yes____ No____ Type____

*How many: Average number ______ Annual number ______

*Does facility have tanks? Yes ______ No ______ Number ______

*Capacities of each? ________________________________

*Quantity handled per unit time? ________________________________

*Does facility have surface impoundments that are used for storage (not disposal)? Yes____ No____

If yes, what type of liner is used? ________________________________

If yes, what groundwater monitoring is present? ________________

If yes, does facility have NPDES permit? Yes____ No____

3. **Wastes:**

What percent of wastes are generated on-site? ______________

*Type/description of wastes being incinerated (Major verified items)

Code Number	Verified Description	Amount Per Unit Time

Figure C-2

Log Sheet for Part A Confirmations

3. Wastes (continued):

*Type/description of wastes being stored in containers
(Major verified items)

Code Number	Verified Description	Amount Per Unit Time

*Type/description of wastes being stored in tanks
(Major verified items)

Code Number	Verified Description	Amount Per Unit Time

*Type/description of wastes being stored in surface impoundments
(Major verified items)

Code Number	Verified Description	Amount Per Unit Time

4. Additional Questions:

A. For all HW incinerators and optional for any non-HW incinerators (boilers, etc.):

Heat recovery? Yes ______ No ______
APCDs? (List) ______________________________
____
Combustion chamber temperature? ______________
Residence time? ______________________________
____
Operating schedule? Hrs./day _____ Days/wk _____ Other ____
Operating schedule December-March? ______________

B. For all facilities:

Is facility in floodplain? Yes ______ No ______
If yes, what year? 50 ____ 100 ____ 500 ____
Does facility have flood protection? Yes ____ No ____
Has facility site had ground slumping, sliding, or movement? Yes ____ No ____ (West of Mississippi River only)

Figure C-2
(continued)

5. Site Visit:

Who should EPA contact for permission to visit site?
(Give name, title and how to contact)

If contact listed above is the same person presently contacted, ask the following:

Conditions on case study? ________________________________

Conditions on stack sampling? ____________________________

6. Cost of incineration:

Commercial: What do you charge customers? ______________

or Private: What are your incinerator operating costs? _____

7. Any additional comments:

Figure C-2
(concluded)

APPENDIX D

EPA HAZARDOUS WASTE NUMBERS USED IN THIS REPORT

Listed below are the identifications of all EPA Hazardous Waste numbers used in this report. These numbers and identifications are extracted from the Federal Register (45FR33119-33133; May 19, 1980 and subsequent ammendments).

D001 - any solid waste that exhibits the characteristic of ignitability, but is not otherwise listed as a hazardous waste.

D002 - any solid waste that exhibits the characteristic of corrosivity, but is not otherwise listed as a hazardous waste.

D003 - any solid waste that exhibits the characteristic of reactivity, but is not otherwise listed as a hazardous waste

other D wastes - any solid waste that exhibits the characteristic of EP toxicity, but is not otherwise listed as a hazardous waste.

F001 - the spent halogenated solvents used in degreasing: tetrachloroethylene, trichloroethylene, methylene chloride, 1,1,1-trichloroethane, carbon tetrachloride, and the chlorinated fluorocarbons; and sludges from the recovery of these solvents in degreasing operations.

F002 - the spent halogenated solvents: tetrachloroethylene, methylene chloride, trichloroethylene, 1,1,1-trichloroethane, chlorobenzene, 1,1,2-trichloro-1,2,2-trifluoroethane, O-dichlorobenzene, trichlorofluoromethane and the still bottoms from the recovery of these solvents.

F003 - the spent non-halogenated solvents: xylene, acetone, ethyl acetate, ethyl benzene, ethyl ether, n-butyl alcohol, cyclohexanone, and the still bottoms from the recovery of these solvents.

F004 - the spent non-halogenated solvents: cresols and cresylic acid, nitrobenzene, and the still bottoms from the recovery of these solvents.

F005 - the spent non-halogenated solvents: methanol, toluene, methyl ethyl ketone, methyl isobutyl ketone, carbon disulfide, isobutanol, pyridine and the still bottoms from the recovery of these solvents.

F006 - wastewater treatment sludges from electroplating operations.

F017 - paint residues generated from industrial painting.

K011 - bottom stream from the wastewater stripper in the production of acrylonitrile

K016 - heavy ends or distillation residues from the production of carbon tetrachloride

K018 - heavy ends from fractionation in ethyl chloride production

K019 - heavy ends from the distillation of ethylene dichloride in ethylene dichloride production

K020 - heavy ends from the distillation of vinyl chloride in vinyl chloride monomer production.

K027 - centrifuge residue from toluene diisocyanate production.

K030 - column bottoms or heavy ends from the combined production of trichloroethylene and perchloroethylene.

K048 - dissolved air flotation (DAF) float from the petroleum refining industry.

K049 - slop oil emulsion solids from the petroleum refining industry.

K051 - API separator sludge from the petroleum refining industry.

K083 - still bottoms from aniline production

P022 - carbon disulfide
P063 - hydrocyanic acid
P068 - methyl hydrazine

P080 - nitrogen tetroxide
P095 - phosgene
U003 - acetonitrile
U019 - benzene
U023 - benzotrichloride
U029 - bromomethane
U037 - chlorobenzene
U045 - chloromethane
U098 - 1,1-dimethylhydrazine
U099 - 1,2-dimethylhydrazine
U122 - formaldehyde
U130 - hexachlorocyclopentadiene
U133 - hydrazine
U154 - methanol
U159 - methyl ethyl ketone
U188 - phenol
U220 - toluene
U239 - xylene

APPENDIX E

REFERENCES

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